Founded 1874—Fifty-Four Years of Service

JUL 23 1928

Electrical World

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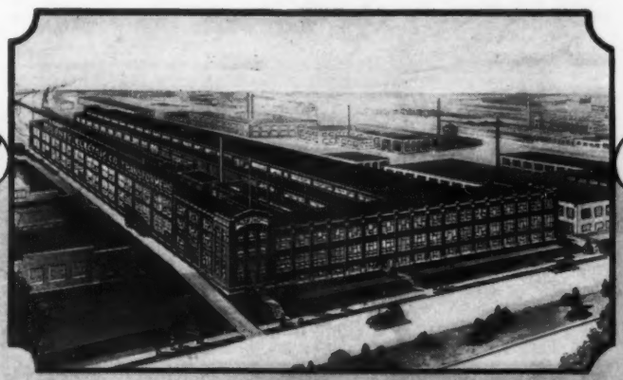

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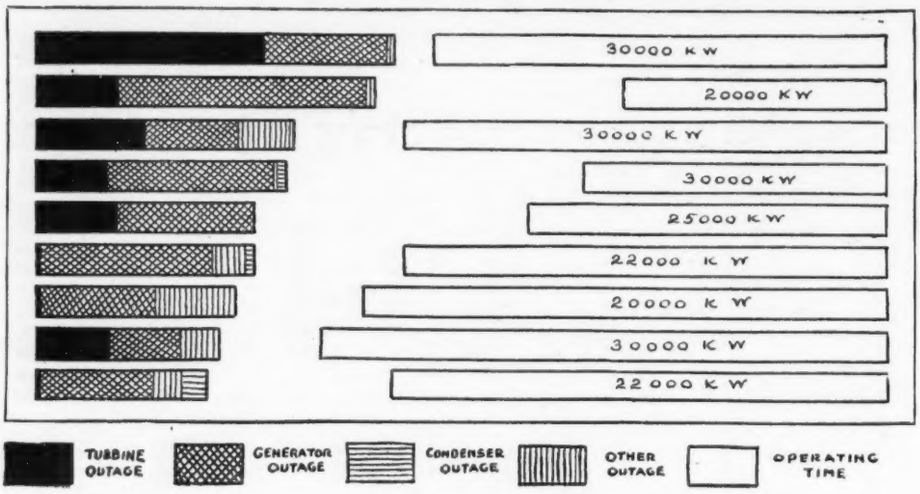

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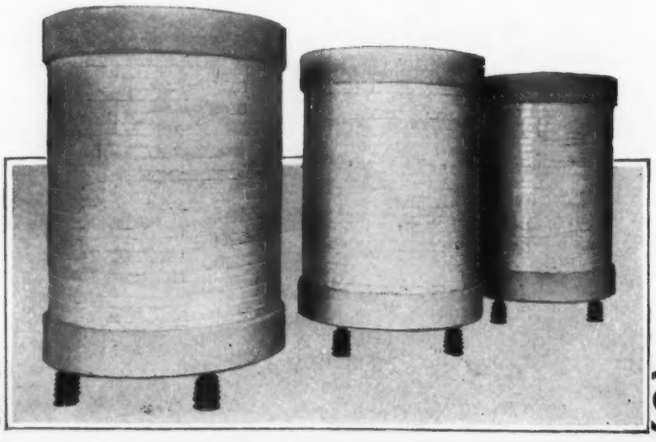

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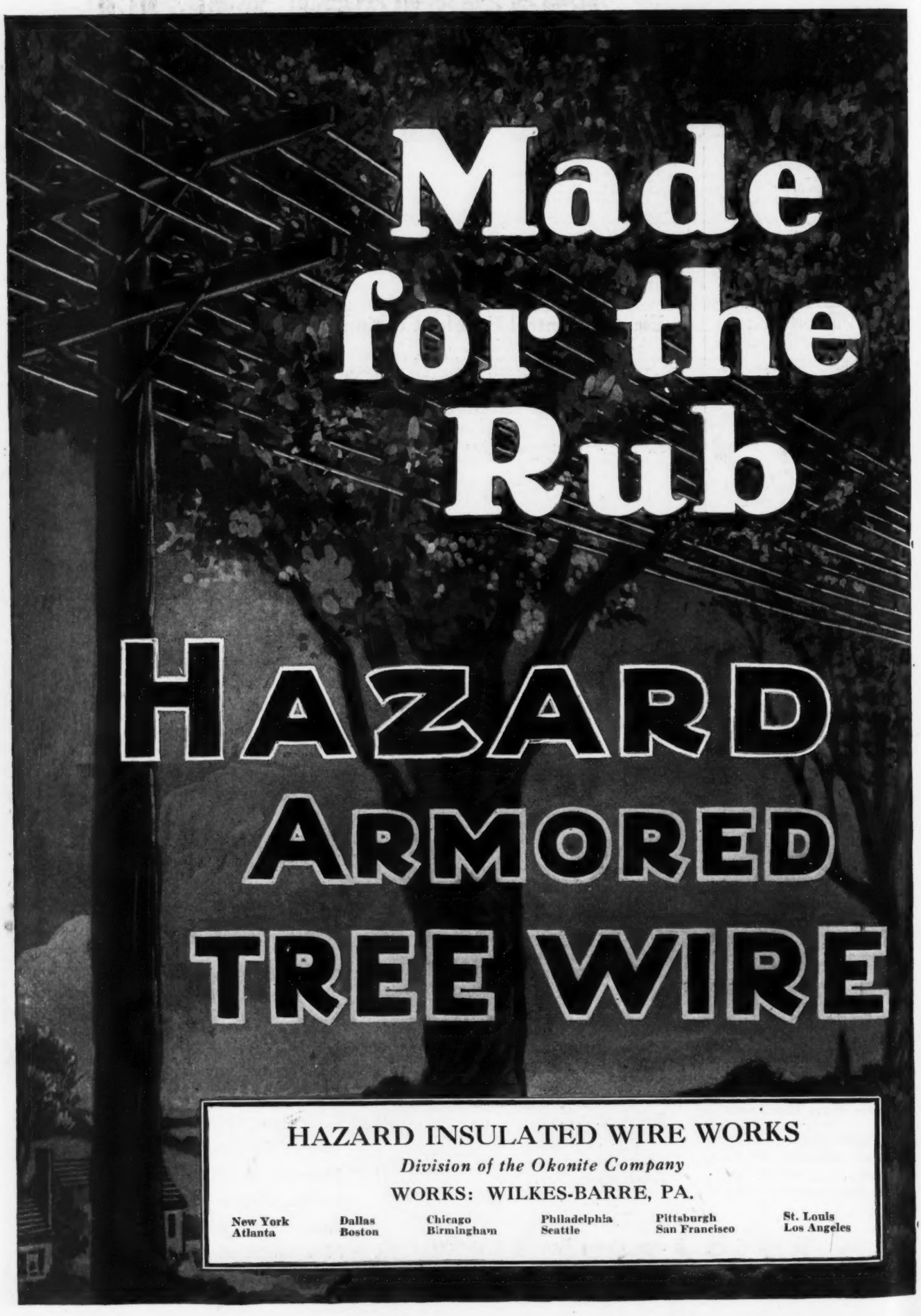
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Research on System Problems

SYSTEM engineering problems rather than apparatus design problems predominate in the light and power industry. This fact raises certain questions as to sharing the cost and responsibility for the development and research work needed to find an answer to the problems. It was reasonable for apparatus manufacturers to do the development and research work on equipment purchased by their customers, but it would also seem reasonable for customers to do most of the development and research work concerned with the assembly and operation of this equipment. Such problems as stability, distribution networks, system communication, inductive co-ordination and lay-outs for interconnected operation belong to utility engineers. Utility engineers should lead and not follow the apparatus specialists trained by the manufacturers, and the cost of development and research work on system problems should be borne largely by the utilities. Of course the manufacturer and his engineers should co-operate in the work, but the division of responsibility and cost should be made more equitably.

Industry progress can best be obtained if the specialist of the manufacturer sticks to his apparatus and if the utilities develop their own specialists on system design and operation. This is a logical, economic and engineering division of functions, and an endeavor to allocate responsibilities and costs to carry out this conception might well be made by utility and manufacturing executives. In the end the total industry cost may be the same, but faster progress and a more equitable division of cost would result from carrying out such a program.

* * * *

The Senator Views with Alarm

SENATOR NORRIS of Nebraska declares that the electric power producers are about to usurp the government. Senator Heflin worries about the Pope's designs on our American democracy. The country is probably safe so long as our senatorial watchdogs are on the job and get a reasonable amount of the publicity they crave.

If the power producers are making such enormous profits as Senator Norris believes they are, the public ought to be pleased to have the facts. There is probably no industrial activity which compares with electric power in the extent to which its securities are owned by the public. A large part of the "insidious propaganda" for electric power interests has been in the form of paid advertising inviting the public to participate in the profits of the industry. Thrifty housewives, workmen, salaried men, business men, and investors in general, have bought these securities in enormous quantities. The judgment of these investors has been vindicated—electric power is a good thing.

Such profits as have been made in electric power have been made by the application of brains to the problem of eliminating waste and unnecessary human labor. The industry has wisely commanded the services of the best engineers and financial men obtainable. These men have earned profits for their stockholders and have been rewarded by being well paid. Employment of high-grade ability to direct the industry has borne fruit. Power service is nearly perfect in the United States—it is supplied at steadily decreasing rates—it pays dividends.

* * * *

The Lesson in the Federal Trade Hearings

IT MUST be frankly recognized that the public reaction to the investigation of the utility information bureaus by the Federal Trade Commission so far has not been favorable to the power industry. It should be realized that such an impression lingers long. And the men of the power companies now face the problem of what to do about it. Mistakes that have been made in policy and in leadership have been made. That water is over the dam. The issue now before the industry is how best to correct this unfortunate impression and establish public confidence in both the motives and the methods of the power companies and to go forward with the development of this essential public service.

Fair or unfair when the investigation is completed, the Federal Trade Commission will report its conclusions to the Senate. The Senate will then sit in judgment, and if public opinion is adverse to the present practices of the power industry, it is possible that Congress will express itself in some sort of regulatory legislation—no man knows what. In face of this, it is manifest folly for any one to say, "We will go forward with our publicity programs unchanged." For the people of the United States own these utility corporations through stockholding, and they control them by the laws of the states administered by special commissions. And if they do not approve of the measures which have been taken by the power industry to combat the propaganda of the proponents of municipal ownership and federal regulation of public utilities, this disapproval cannot be overcome by intensified publicity of the same sort. Some other way must be found to tell the story of the power industry and to interpret the social and economic values of the great service that it renders to the domestic, commercial and industrial life of America.

It might be well to look about a bit and study some of the other great industries. How do they develop their markets and maintain popularity for their product? For, after all, that is the nubbin of it. The power company is not a philanthropic institution. It is a manufacturing

enterprise, producing a commodity for sale to the public. This commodity is delivered in the form of a service. Otherwise it is little different from the products of other industries, and it would seem that methods that have proved successful in these other markets might well be adapted to our own.

Such a comparison is illuminating. For it is seen that while the manufacturers of automobiles, phonographs, cigarettes and silk stockings defend and promote their position in the market place by straightforward sales methods that popularize the product, the manufacturers of electric power have applied their energies most conspicuously in an effort to win public approval and support by talking about themselves and enlarging upon the splendor of their beneficent contribution to human happiness. The lesson in the Trade Commission hearings so far, then, would seem to be the futility of press agents and propaganda as compared with the known values of modern merchandising supported by plain speech in paid advertising. For these are the two proved resources upon which most other industries rely for both protection and prosperity.

* * * *

Cable Terminal Failures Due to Corona Formation

RECENT investigation of the cause of failure of 25-kv. outdoor cable terminals revealed the important fact that where there was an air space between the cable insulation and the porcelain shell corona formed at the surprisingly low tension of 22.7 kv. The thin layer of air, being in series with cable insulation and porcelain, both of high permittivity, is subjected to high dielectric flux density and hence to high-voltage gradients at low operating voltages. The method of determining the voltage at which corona began to form within the terminal was rather ingenious. Rubber hose was inserted into two holes drilled through the porcelain, and this hose was used as a stethoscope.

Further investigation showed that internal flashovers caused by unfilled air spaces in vital parts of the terminal, into which humid air is breathed, are followed by power arcs which liberate large quantities of gas and cause an explosion of the terminal. The fact that cable terminals completely filled with insulating compound withstood repeated flashovers without breakdown of the insulation indicates that failures of the nature under investigation can be avoided by displacing all air inside the terminal with insulating compound.

* * * *

Improved Street Lighting Improves All Illumination

COMMERCIAL departments of the more aggressive central-station companies have organized for effective merchandising of street-lighting service. This activity is recognized as a builder of good will and stimulator of sales. It is the logical approach to better window lighting, to increased intensities in store lighting and to more and better street lighting in other communities. Concurrently a demand is created for improved home lighting and the entire lighting field takes on activity.

Utility companies that have aggressively developed improved street lighting have found that exactly these results ensue. The public looks to the electric light and power company for information on street-lighting practice. Whether or not the utility actually sells or maintains this service, it should encourage and help to develop this business. The effects of the street-lighting systems are far-reaching.

Street lighting constitutes one of the visible utility services with which all citizens are familiar. The degree of perfection attained in lighting the streets of a town will frequently be a measure of the degree of perfection in all other classes of service. The commercial department must be responsible for street-lighting improvement and must take the initiative in promoting this business whenever possible.

* * * *

Financial Statements Should Help Make Friends

ABRIDGMENT of the financial statement is undoubtedly commendable as an economy. Beyond certain reasonable limits, size defeats its purpose and has an adverse influence on public relations. Certainly the trend is toward more adequate and intelligible annual statements, but many companies are still issuing their reports in the old stilted and hopelessly inadequate form which tells the shareholder or owner of the company little beyond revenues.

One of the latter type—and by the way, that of an important utility—attracts our attention by its utter lack of any definite information beyond the mere "skin and bones." Analyzing the income account, one finds that, after gross revenue, a single item combines operating costs, taxes and a retirement reserve. No mention whatever is made of maintenance costs. After net earnings, which increased about 14 per cent, an item designated "interest and income deductions" shows a 35 per cent increase. After deduction of this item, net income shows less than a one per cent increase. The unfortunate reader is left entirely at sea as to the significance of these last items. He naturally wonders why so large an increase in the "interest and income deduction" item has not been attended by some worth-while increase in profits, especially as operating costs have changed little.

At the other end of the scale is the really complete and intelligible statement issued in attractive form and effectively designed to influence public relations favorably. Of this type the 1928 "Yearbook" of the Commonwealth Edison Company of Chicago is a creditable example. It is not only a very fine example of typography and layout —which can be said of some other publications—but its contents are pertinent, understandable and interesting —which cannot always be said of many publications. Its thirty-two pages are filled with the answers to questions concerning the company that are continually arising in the minds of security holders and the public. Among the subjects treated are the organization of the company as an operating unit, a retrospect of the past year, an analysis of income, expense and investment, a résumé of recent financing, a discussion of the new residential rate, a twenty-year review of the company's growth, fuel conservation and supply and a statement on the development of new business. Each item is accompanied by an explanatory note.

Such a bid for public interest and friendship cannot but have its effect. Moreover, shareholders have a right to an adequate, financial accounting by the company's officers.

One Reason for More Sales Man-Power

A POWER company operating in a rather widely scattered territory was badly upset recently when it learned that one of its larger customers was seriously considering a plant of its own. Action by the power company was prompt and effective. It was demonstrated to the customer, eventually, that he could not profitably operate an isolated plant; but during the numerous discussions the customer very pointedly asked the utility's representative why he had not shown any interest in his interrogator's welfare before. It developed that until the question of the new plant came up no one from the power company had called upon this customer, even to pass the time of day, in the last three years. The meters were read, bills rendered and paid, and that was that.

Of course, there is such a thing as being too solicitous for a customer's wellbeing. There is a certain danger of becoming pestiferous, and a man who is looking for trouble will surely find some one to accommodate him. But failure to keep acquainted with what is going on in a customer's mind and in his plant for a period of three years is certainly flying in the face of misfortune. This instance shows the need for adequate man power in the utility sales department and for a systematic periodical check on conditions at industrial customers' plants. As the result of its experience this company has increased its power sales force, and the sales engineer in each district must pay a friendly visit to each individual customer in his territory at least twice a year—oftener if active changes are going on in the plant. Utility companies that do not have similar intimate contact with their industrial customers might well ponder what their procedure will be when a large user suddenly becomes interested in making his own power.

* * * *

Power and Fishing Interests Again Clash

FOLLOWING the example of California in closing the Klamath River to power development a few years ago by popular vote, fishing interests of Oregon are circulating petitions to have bills placed on the November ballot which would prohibit any further appropriations for power or other developments on the Rogue, Umpqua, Mackenzie and Deschutes Rivers. The expressed purpose of the bills is to preserve these streams for food and game fish propagation and recreational purposes.

The existing filings on these streams would not be affected if the bills are enacted unless any such filings should revert to the state of Oregon for some reason, and hence the measures are not as pernicious as the Klamath River bill. Nevertheless, they are menacing to future hydro-electric development in the Northwest. If power companies sit idly by and do not vigorously oppose the bill they may suffer the same experience as power companies in California which let the Klamath bill pass by sentimental appeal.

There is no reason or necessity for closing any streams of the West to hydro-electric development to protect fish. The success in taking fish over the 245-ft. Baker River dam in Washington has demonstrated that fishing and power interests are not incompatible. Moreover, it can be shown that fishing on many streams has been improved by the establishment of hatcheries and fish planting after dams have been constructed.

The public or its representatives must be shown that there are already enough hampering restrictions to the development of hydro-electric power and that further restrictions will force companies to steam generation, thereby defeating the long-cherished ideals of water-power conservation.

* * * *

Importance of Protecting Generators Against Fire

WHEN a power company loses the generating capacity of a large unit for a week or ten days because of a fire in the machine renewed interest in fire protection should result. Especially is this true when the loss of the generator is costing the company from a thousand to two thousand dollars an hour, to say nothing of the cost of actual repairs. The fact that in many cases the loss sustained would more than pay the cost of modern and adequate fire protection for all the generators and synchronous condensers on the system should cause serious reflection on the part of engineers and operators. It is assumed, of course, that precautions to prevent internal trouble in generators will be taken before remedial measures are adopted.

* * * *

Visiting in a Neighbor's House

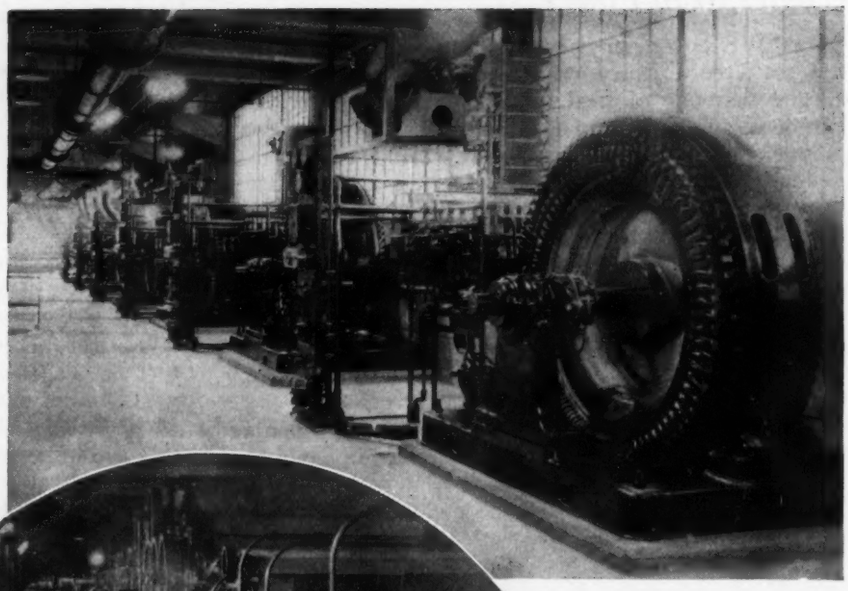
IT IS usually in the family circle that men talk most candidly of their private affairs. Industries have their family-circle gatherings in the form of conventions. Friendly neighbors from other industries may drop in and sometimes profit from what they hear. There were at least two contributions to the convention of the Iron and Steel Electrical Engineers in Chicago recently from which central-station men might extract value.

The first of these was the report of the electric heat committee. It contained a long series of descriptions of applications, actual and suggested, and of specific installations giving kilowatt-hours per ton of metal, opinions of users, methods of control and much other pertinent information. The data compiled in this report should be distinctly valuable to power-company executives and industrial heating salesmen.

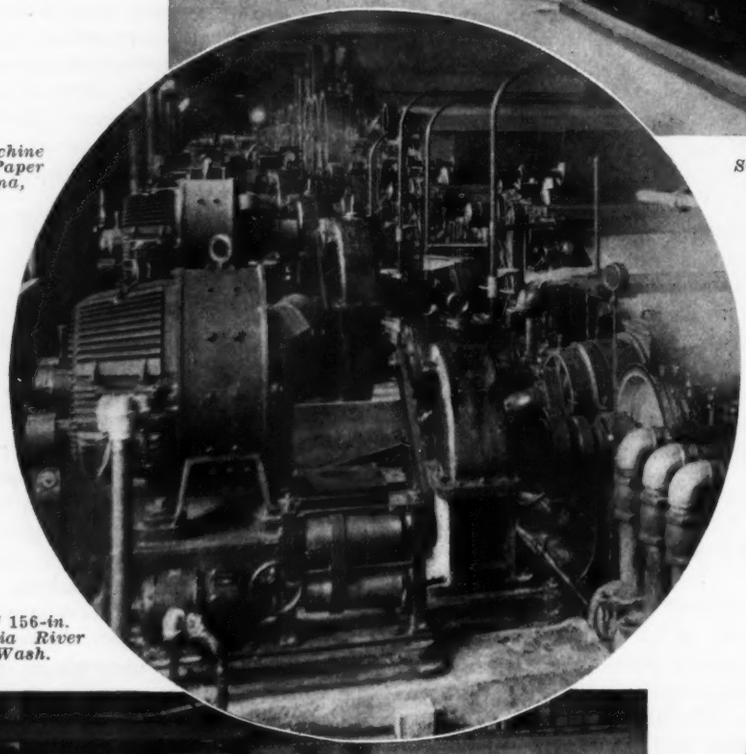
The second paper of the convention that should be of peculiar interest to central-station men was the one by W. B. Skinkle entitled "Discussion of the Elements Entering Into the Cost of Producing Power." Mr. Skinkle is engineer of the Pittsburgh district power committee of the United States Steel Corporation subsidiaries so that the practices related in his paper may be considered representative of probably the largest industrial producer of power in the country. The cost items are set up in two sections—for steam production and for electricity production. It is in the assignment of proportion of cost of each item as between variable and constant factors that the paper possesses most interest. Probably not all or very many central-station production men would wholly agree with the analyses by which these assignments are made, but in forming opinions disagreements are as useful as agreements.

Although only two features of the convention program are here specifically mentioned, they are representative rather than exceptional. It would pay many central-station companies to obtain copies of these and the other papers and give them attentive reading.

Recent Northwest Paper Mill Installations

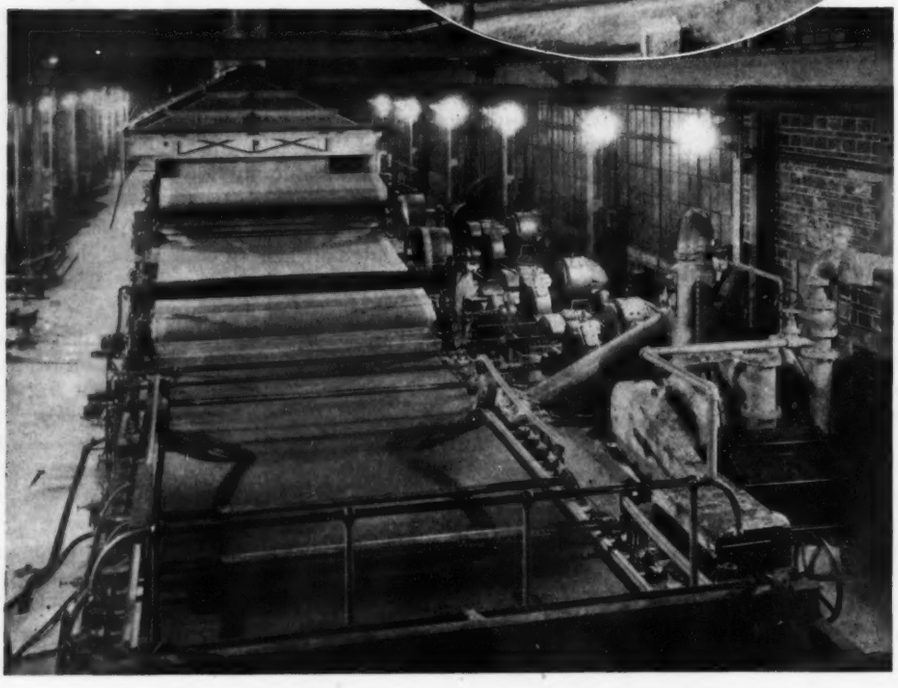


Six 1,000-hp. synchronous motors with automatic control driving pulp grinders, Washington Pulp & Paper Company, Port Angeles, Wash.



Sectional paper machine drive, Cascade Paper Company, Tacoma, Wash.

Motor drive on wet end of 156-in. paper machine, Columbia River Paper Mills, Vancouver, Wash.



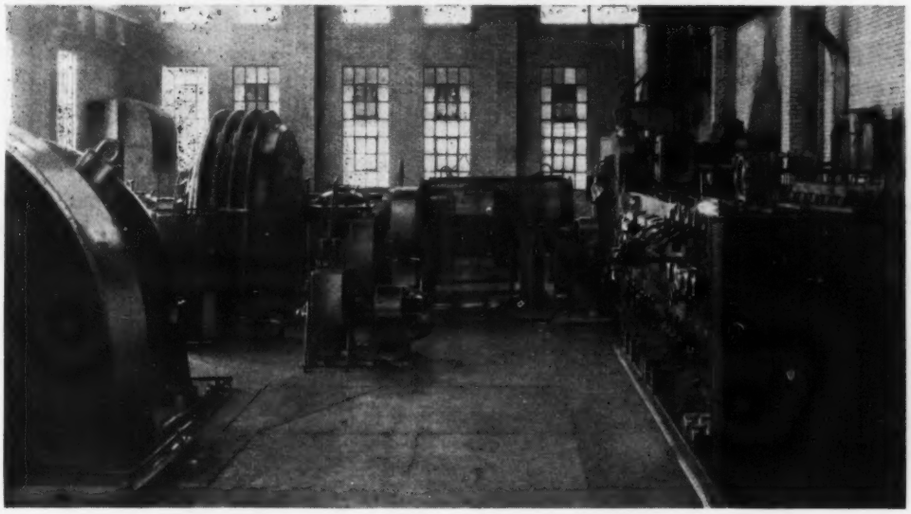
ABUNDANT hydro-electric power supply and large stands of pulp wood are attracting many new pulp and paper enterprises to the Pacific Northwest each year. At present there are 22 pulp and paper mills, with a motor load of 136,827 hp., operating in Oregon and Washington and two new mills are under construction. Central-station power is largely utilized.

Electric Control Enables

Continuous Sheet Rolling

Electrification of Ashland, Ky., plant of American Rolling Mill Company increases output per workman, reduces hand labor and maintains high standard of product

By T. J. FLAHERTY* and A. F. KENYON†



Blooming mill motor and control

HAND LABOR, which is so conspicuous in the average sheet steel mill for passing bars between and over rolls, has been notably reduced in the continuous sheet rolling mill at the Ashland, Ky., plant of the American Rolling Mill Company. All operations are mechanically performed, the output per workman is enormously increased and the quality of product is maintained at a high standard, due to the uniformity of processing and the elimination of the human element. The use of electrically driven machines in all parts of the plant has contributed greatly to the success of this radical departure from the earlier methods of sheet rolling.

A brief review of the rolling operation will show the salient features of the layout for continuous processing and serves to indicate the necessity for simple and reliable electrical drives, for the operation of practically the entire mill depends on the uninterrupted operation of each component drive.

Molten pig iron is received in ladle cars from the company's blast furnaces, held in a hot-metal mixer until needed and then charged with a certain amount of scrap into the open-hearth furnaces. The refined steel is cast into ingots weighing about 11,000 lb. and measuring 19 x 39 in. in cross-section. After stripping the molds the ingots are soaked to an even rolling temperature and then delivered by the ingot chariot to the approach table of a 36-in. motor-driven reversing blooming mill. Here, in about 21 passes through the rolls, the ingots are reduced to slabs approximately 4 in. thick by 36 in. wide and 23 ft. long.

From this stage on, the practice is radically different from other sheet mills, all processes being continuous from mill to mill, with the advantages of low labor cost, high tonnage output and uniform quality of product.

From the blooming mill the 4-in. thick slabs are carried through a 30-ft. holding furnace, which raises their temperature, and as they emerge they are sheared into suitable lengths, the pieces turned 90 deg., and delivered to the first stand of the bar plate mill. This mill consists of seven stands of 30-in. x 58-in. rolls, with several edging stands, arranged in line so that the slab sections pass successively through all the stands. Each stand is driven by a separate constant-speed induction motor, connected to the mill through a herringbone reduction gear. As the pieces leave the last stand of the bar plate mill they are about $\frac{7}{16}$ in. thick by 27 ft. long and of a width slightly greater than the desired finished sheet width.

In line with the bar plate mill is a second holding furnace and the jobbing mill. As the bar plates emerge from this furnace they are sheared to lengths at the rate of 30 or more pieces per minute and fed directly into the seven-stand jobbing mill, which consists of four two-high 30-in. x 58-in. stands and three three-high 30-in.

*Electrical superintendent American Rolling Mill Company, Ashland, Ky.

†General engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

and 14-in. x 58-in. stands. The seven stands of the jobbing mill are driven by three induction motors, through primary and secondary reduction-gear units. The product issuing from the jobbing mill varies in size according to the order being rolled, the length usually being about 10 ft., the width up to a maximum of 48 in. and the thickness ranging from ¼ in. down to 16 gage, the average being about 13 gage.

Following this operation the treatment given the roughed plates depends on the grade of sheets to be finished. Usually the plates are matched in pairs, sheared on sides and ends and fed into a 140-ft. continuous heating furnace preceding the sheet mill. This mill consists of five stands of three-high 30-in. and 14-in. x 48-in. rolls, each stand driven at about 25 r.p.m. by a separate induction motor. Short reheating furnaces between stands 2 and 3, 3 and 4 and 4 and 5 maintain the thin sheet material at the proper rolling temperature.

Static condensers correct power factor

The 480-kva. static condenser in the bar plate mill control room, illustrated above, affords correction for the 2,300-volt system. A similar installation of 360-kva. capacity is located in the sheet mill control room.

Sheets of a maximum width of 41 in. and minimum thickness of 20 gage can be produced on this mill. Pairs of sheets are finished at the rate of about fifteen per minute.

A similar labor-saving idea is applied to the annealing and pickling of the sheets. The rolled sheets are formed into a continuous ribbon by stitching together the overlapped ends, and this belt of steel is passed through the annealing furnace and cooling hood, directly into the successive pickling and washing vats. As it leaves the last vat of the continuous pickling machine the strip passes through a tandem shear which cuts out the stitched joint. The sheets are then piled and carried by overhead crane to the cold rolling department.

The cold roll mills consist of eight trains of from two to five stands of 26-in. x 56-in. rolls each. Each train of rolls is driven at about 30 r.p.m. by a constant-speed induction motor, through reduction gears.

The procedure varies according to the finish and temper required for the sheet, but the usual practice is to give the sheets from the pickling machine about four cold roll passes, then box anneal, and finally give a finish cold rolling of from one to four passes. After the final cold rolling the sheets are sheared to exact size, roller leveled and removed to the warehouse for shipping, or to the galvanizing and other finishing departments.

To provide additional finishing capacity and make possible the production of other grades of sheets there has just been installed a five-stand 34-in. and 14-in. x 58-in., four-high, roller-bearing, tandem cold strip mill, designed to take the rough plates as produced by the jobbing mill and make the reduction down to 20 gage or lighter. Each stand of this mill is driven by a separate 600-hp., adjustable-speed, direct-current motor.

TABLE I—CHARACTER OF CONTINUOUS SHEET MILL MAIN-ROLL DRIVES

No.	Mill, Size and Type Inches		Hp.	R.P.M.	Voltage	Cycles	Mill R.P.M.
1	36	Reversing blooming	2,500	50/120	600	d.c.	0/120
2	30x58	Bar plate—No. 1	300	585	2,200	60	14
3	30x58	Bar plate—No. 2	300	585	2,200	60	20
4	30x58	Bar plate—No. 3	300	585	2,200	60	25
5	30x58	Bar plate—No. 4	500	585	2,200	60	25
6	30x58	Bar plate—No. 5	500	585	2,200	60	25
7	30x58	Bar plate—No. 6	600	870	2,200	60	36
8	30x58	Bar plate—No. 7	600	870	2,200	60	36
9	30x58	Jobbing—Nos. 1–2	2,000	505	6,600	60	45–45
10	30x58	Jobbing—Nos. 3–4	3,000	505	6,600	60	45–45
11	30 and 14x58	Jobbing—Nos. 5–6–7	1,800	370/247	6,600	60	43–51–57/65–75–85
12	30 and 14x48	Sheet—No. 1	300	585	2,200	60	25
13	30 and 14x48	Sheet—No. 2	400	585	2,200	60	25
14	30 and 14x48	Sheet—No. 3	400	585	2,200	60	25
15	30 and 14x48	Sheet—No. 4	400	585	2,200	60	25
16	30 and 14x48	Sheet—No. 5	500	585	2,200	60	25
17	26x56	Cold roll—No. 1	300	585	2,200	60	30
18	26x56	Cold roll—No. 2	300	585	2,200	60	30
19	26x56	Cold roll—No. 3	300	585	2,200	60	30
20	26x56	Cold roll—No. 4	300	585	2,200	60	30
21	26x56	Cold roll—No. 5	300	585	2,200	60	30
22	26x56	Cold roll—No. 6	300	585	2,200	60	30
23	26x56	Cold roll—No. 7	300	585	2,200	60	30
24	26x56	Cold roll—No. 8	400	585	2,200	60	30
25	34 and 14x58	Cold strip—No. 1	600	400/800	230	d.c.	.....
26	34 and 14x58	Cold strip—No. 2	600	400/800	230	d.c.	.....
27	34 and 14x58	Cold strip—No. 3	600	400/800	230	d.c.	.....
28	34 and 14x58	Cold strip—No. 4	600	400/800	230	d.c.	.....
29	34 and 14x58	Cold strip—No. 5	600	400/800	230	d.c.	.....

Motor Drives and Control

The main rolls of the bar plate, jobbing, sheet and cold roll mills run continuously and at approximately constant speed, so that wound-rotor induction motors are ideally suited to these applications. Squirrel-cage motors can be used for many of the small auxiliaries, such as pumps, conveyors, shears, etc. Other auxiliaries and the cold strip mill main rolls require adjustable-speed motors, and the cranes and heavy reversing auxiliaries on the blooming and bar plate mills require mill-type motors, so that considerable direct-current capacity in motor-generator sets is necessary.

The 36-in. blooming mill is driven by a 2,500-hp., 50/120-r.p.m., 600-volt, direct-current reversing motor, coupled directly to the lower mill pinion. Power for this reversing motor is supplied from a flywheel motor-gen-

TABLE II—AVERAGE ENERGY CONSUMPTION DURING 1926 AT ASHLAND PLANT OF AMERICAN ROLLING MILL COMPANY

The tonnage output figures for items 1, 2, 3 and 4 are in gross tons (2,240 lb.). For items 5, 6, 7 and 8 they are in net tons (2,000 lb.). The tonnage output in item 7 is for single pass cold rolling. Items 9 and 10 are based on the output of the blooming mill. These items are total for the plant and are included in the detail figures of the other items.

No.	Mill or Department	Average Monthly Output, Tons	Kw.-Hr. Consumption per Ton Output: Roll Motors	440 Volt Auxiliary	250 Volt Auxiliary	110 Volt Lights	Total
1	Blast-furnaces	11,850	.....	....	....	....	6.61
2	Open-hearth furnaces	20,000	.....	7.02	5.00	0.67	12.69
3	Blooming mill	19,450	12.75	3.83	3.93	0.25	20.76
4	Bar plate mill	17,150	25.90	3.63	1.64	0.50	31.67
5	Jobbing mill	16,700	69.20	8.06	5.48	0.98	83.72
6	Sheet mill	7,185	40.15	10.29	4.67	2.25	57.36
7	Cold roll mill	25,815	16.16	2.33	1.45	0.84	20.78
8	Galvanizing department	4,275	3.29	9.75	8.25	5.55	26.84
9	Pumps and air compressors	19,450	.....	....	....	....	24.55
10	Lights, all departments	19,450	.....	....	....	....	11.27

erator set rated at 2,000 kw. and having a 55,000-lb. flywheel; a 1,500-hp., 6,600-volt, wound-rotor induction motor drives the unit. Control of the direction of rotation and speed of the reversing motor is accomplished by magnetic contactors in the field circuits of the generator and motor. A liquid slip regulator in the secondary circuit of the 1,500-hp. motor inserts resistance as load rises, thus slowing down the flywheel set and enabling the flywheel to give up some of its stored energy. The power demand on the supply system is thereby kept fairly constant, despite the extremely fluctuating duty of the blooming mill.

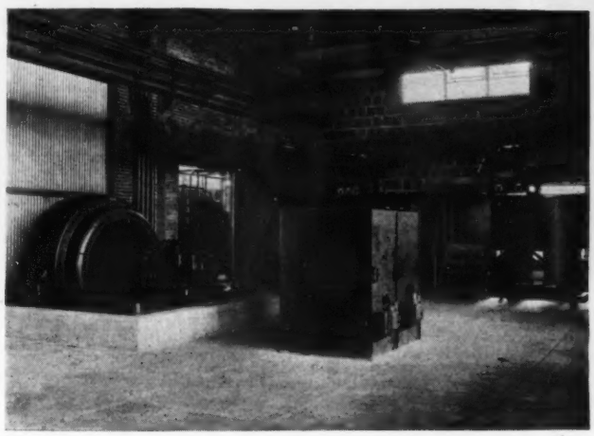
Originally the reversing equipment was installed with a separate motor-driven exciter set. Upon interruption of the power supply the excitation would fail almost instantly, so that the mill was often stopped with steel in the rolls. Consequently, an exciter was coupled to the flywheel set, and it is now found that the stored energy is sufficient to make several passes in the mill after the power is cut off from the induction motor driving the reversing equipment.

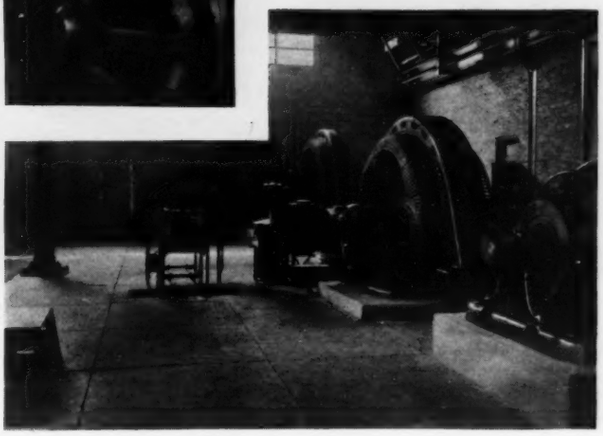
The blooming mill auxiliaries—tables, screwdown, side guards and manipulator fingers—are driven by totally inclosed, mill-type, series, direct-current motors, controlled by reversing magnetic controllers and mill master switches. To avoid delays which might be caused by trouble with the auxiliary control equipment duplicate controllers are provided for essential auxiliaries. This feature also facilitates regular maintenance and inspection, enabling the equipment to be kept in better operating condition.

Each of the seven stands of the bar plate mill is driven by an individual bracket-type, wound-rotor induction motor, attached to the mill through a flexible coupling and double-reduction herringbone-gear unit. Passes in the mill are of short duration and peak-load demands are high, so flywheels are overhung on the pinion shafts of each of the gear units. The motors on the first three stands have magnetic secondary control, with about 10 per cent of permanent slip resistance to give the motor a drooping speed characteristic and thus utilize the stored energy of the flywheels. The motors on the last four stands are provided with liquid slip regulator secondary control.

The bar plate mill control room is elevated on one side of the mill building, so that the operator has a clear view of the mill. A panel is provided for each motor and is equipped with an indicating ammeter and wattmeter, watt-hour meter, overload and low-voltage relays. Manual operation is used for the forward and reverse oil circuit breakers. Each motor is equipped with imbedded thermocouples, the leads of which are brought to an indicator panel in the control room so the operator is able to watch the machine temperatures and prevent overloading. Indicating ammeters are also mounted beside the mill stands so that the roller may have a continuous indication of the approximate load on each motor.

At right—Seven 300-hp. and one 400-hp. wound rotor induction motors drive cold-roll mills





Jobbing mill drive and Scherbius regulator sets

No. 1 jobbing mill drive consists of a 2,000-hp. motor with oil circuit breakers and automatic slip regulators. The Scherbius regulating equipment permits speed regulation between 370 and 247 r.p.m.

The jobbing mill drives are in the central power distribution station and their control is incorporated in the main switchboard. Originally the first four stands were driven by two 2,000-hp., 505-r.p.m., 6,600-volt, pedestal-type wound-rotor induction motors and the last three stands were driven by an 1,800-hp., 300-r.p.m., 6,600-volt induction motor, with Scherbius regulating equipment to give speeds from 370 down to 247 r.p.m. Higher production rates have increased the average loads so that the second 2,000-hp. motor is now being replaced by one of 3,000-hp. capacity. The new 3,000-hp. motor is being made to fit on the old bedplate and bearings, so that the old 2,000-hp. motor can be carried as a spare for both the 3,000-hp. and 2,000-hp. motors. Each of the jobbing mill gear units is provided with flywheels, as passes are short and peak loads high; the motor secondary is controlled by a slip regulator.

The sheet mill motor installation is similar to that of the bar plate mill. The motors are in the main mill building, adjacent to the mills they drive, while the con-

trol is in an addition at one side of the building. All of the mill drives have flywheels and each motor has a liquid slip regulator for secondary control during starting and running.

The cold-roll motor installation is similar to that of the bar plate and sheet mills, with the exception of the secondary control. Peak loads are not severe, hence flywheels are not required. However, the torque required to start the mill, after it has been down for several days in cold weather, may be as much as twice the normal full-load running torque, and the control must be able to care for this heavy starting load. This is accomplished by the use of a pilot-motor-driven drum accelerating switch, with starting resistance, giving time-element acceleration and providing maximum starting torque up to the capacity of the driving motor.

The cold strip mill was placed in operation recently to supplement the previous capacity for the further reduction of the rough plates from the jobbing mill and to provide facilities for the finishing of longer lengths of sheets. This mill is of the most modern type, known as four-high, in which the small diameter working rolls are supported against bending by large-diameter backing-up rolls. To reduce bearing friction to a minimum the backing-up rolls are carried in roller bearings.

Each of the five stands of the cold strip mill is driven by a 600-hp., 230-volt, 400/800-r.p.m. direct-current adjustable-speed motor, attached to the mill through a flexible coupling and double-reduction herringbone-gear unit. Controllers are of the pilot-motor-driven accelerating drum switch type, giving time-element acceleration. Sufficient torque may thus be developed to start the motors with steel in the mills. "Start" and "stop" push buttons and field rheostats for speed adjustment are mounted on the side of the mill housings, so that the mill operators may have full control of operation.

Power for the operation of the 600-hp. cold strip mill motors and also for part of the mill auxiliaries is supplied by two 1,000-kw., 250-volt motor-generator sets with 6,600-volt, 80 per cent power-factor motors, located in the cold strip mill. The 6,600-volt circuits are controlled by truck-mounted oil circuit breakers in steel inclosures.

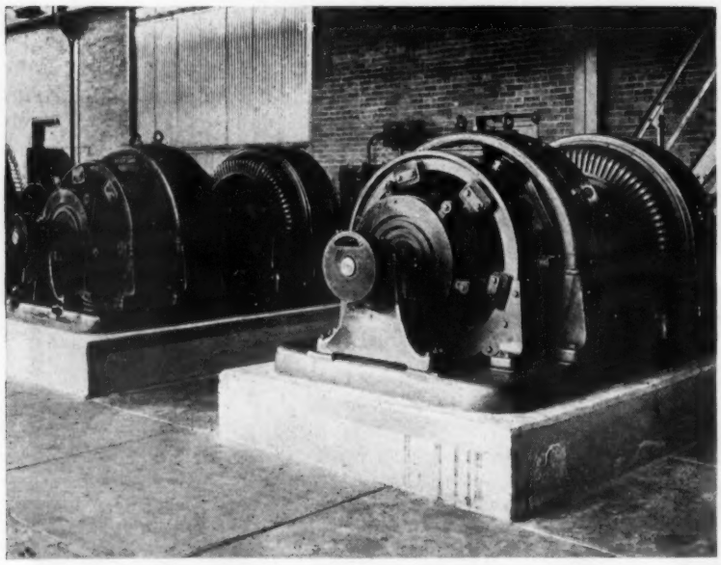
An interesting feature of the cold strip mill is the motor-driven screwdown on each side of each stand. The motors are geared 500/1 and the screws are of 0.25 in. pitch, so that one revolution of the screwdown motor moves the roll up or down only 0.0005 in. This fine adjustment is very desirable in order to permit finishing straight strips of uniform thickness. A control system involving special limit switches is provided, so that a single depression of the "inching" push button causes the screwdown motor to move one revolution. Master switches permit operating the motors in the regular manner for making large adjustments or when opening the mill preparatory to changing rolls. Each mill stand has two 15-hp. screwdown motors, one for each end of the rolls.

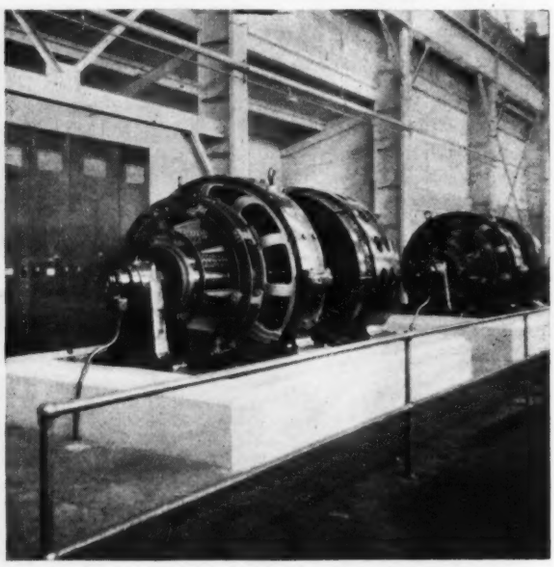
In the continuous processing of the steel sheets movement from mill to mill is almost entirely conducted by means of motor-driven roller and chain tables. For instance, the metal being worked is conveyed through the blooming, bar plate and jobbing mills in a straight line on successive tables and is handled entirely by automatic mechanical means.

After the product emerges from the jobbing mill the treatment is so varied that automatic conveying tables cannot be readily utilized. Therefore metal handling from this point is largely by overhead cranes and by trailer cars drawn by storage-battery locomotives.

Forty-two electric cranes with a combined lifting capacity of about 1,200 tons are used in the blast furnace, open-hearth and mill sections. These cranes range in capacity from a 175-ton steel ladle crane in the open-hearth building down to a 1-ton crane in the boiler house. The cranes in the mills for handling the piles of sheets are from 10 ton to 40 ton capacity. The cranes require 146 motors totaling 5,062 hp. and thus constitute more than a third of the direct-current load.

For handling trailing loads up to about 10 tons be-





Motor-generator sets supply direct-current power

Equipment located near the points of utilization supplies direct-current energy. The view at left shows 250-volt direct-current main power supply equipment.

In the view at right two 1,000-kw. synchronous motor-generator sets for cold strip mill supply are illustrated.

Note truck-mounted oil circuit breakers in background and high foundation of machines, eliminating pit construction.

tween buildings there are three 3-ton and nine 2-ton storage battery locomotives. These locomotives use 72-volt nickel-alkaline cell batteries, which have proved quite successful for this service. The batteries are charged from the 250-volt direct-current system, using either a resistor or connecting two or three batteries in series. In the shipping department are three storage battery trucks with 10-ton lift tables. These trucks are quite compact and easily operated, so that the sheets are carried directly into the railroad cars and packed with very little manual work.

Recently there has been placed in service a 60-ton Diesel-electric locomotive, equipped with a 300-hp. solid-injection oil engine, a 200-kw. generator and four 100-hp. traction motors. This locomotive is in the same service as the 75-ton steam locomotives used in the steel plant yard. It is probable that additional Diesel-electric units will be installed as the steam locomotives become worn and must be replaced.

Mill Output and Energy Consumption

The Ashland plant has been able to operate at nearly capacity output at all times and thus maintain a very desirable load for the Appalachian Electric Power Company, from which it purchases energy. During 1926 the plant had an average monthly energy consumption of approximately 3,950,000 kw.-hr with an average maximum fifteen-minute demand of about 11,150 kw. This corresponds to an average load factor for the year of about 49 per cent, which is considered exceptionally good for a plant of this nature. The average power factor was 86 per cent. For the first eleven months of 1927 the average monthly energy consumption has been nearly 5,250,000 kw.-hr., which reflects the material increase in output over previous years.

Methods are constantly being improved, and developments which increase the capacity of the plant are still being made, so that the capacity of the plant has not as yet been determined. A month after being placed in operation the plant was turning out 350 tons of sheets per day. Now, after four years of operation, outputs up to 1,400 tons per day are being produced. The ten-hour turn record to date for the blooming, bar plate and jobbing mills is 162 11,000-lb. ingots, corresponding to nearly 1,600 ingot tons per day of two turns.

Obviously, the unit energy consumption varies for different products and for various conditions of rolling. In an accompanying table are presented data showing the average gross monthly output of each department, with the corresponding unit energy consumption of each class of electric service.

Power Factor

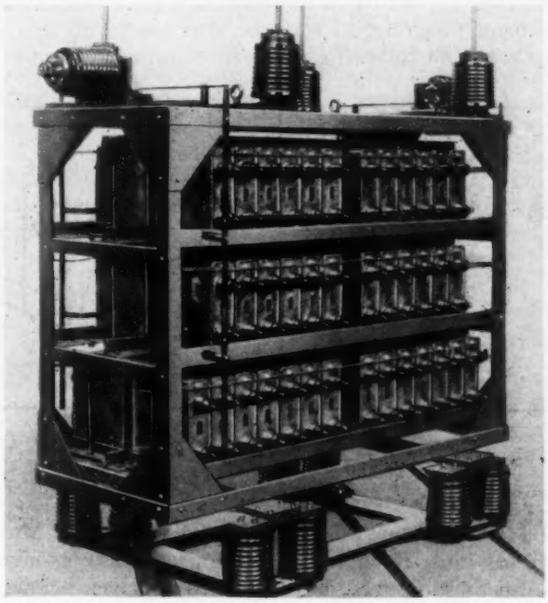
The contract under which electric power is purchased specifies a penalty for average power factor below 85 per cent and a corresponding bonus if the average power factor is maintained above 90 per cent. It is, therefore, desirable to keep the power factor at as high a value as possible, and considerable attention has been paid to means for improving the power-factor conditions.

A static condenser of 480 kva. capacity is installed on the 2,200-volt bus in the bar plate mill control room, and a similar 360-kva. unit is installed in the sheet mill control room. These static condensers have operated quite satisfactorily and have proved their worth in reducing power bills.

The 80 per cent power-factor synchronous-driving motors on the 3,500 kw. capacity of motor-generator sets and the smaller synchronous motors on air compressors also supply considerable leading reactive kilovolt-amperes. For the year 1926, before the two 1,000-kw. motor-generator sets were installed at the cold strip mill, the average plant power factor was maintained at about 86 per cent.

Series Capacitors Compensate for Line Reactance

SERIES capacitors, located in the 33,000-volt, 7,500-kva. transmission line of the New York Power & Light Corporation running between Amsterdam and Ballston substation are said to compensate completely for transformer and line reactance at all loads. The installation, which has been in successful continuous



Internal assembly of 415-kva., 3,170-volt series capacitor for line compensation

operation since February of this year, indicates the practicability of transmitting power through the dielectric of the capacitor units. Automatic protection equipment is included which has satisfactorily met all conditions of switching, short circuit and lightning encountered in the several months of operation.

The installation consists of three single-phase capacitors, each rated at 415 kva., 3,170 volts, 132 amp. Each capacitor is mounted in an oil-filled tank and is completely self-contained. The protective equipment consists of a sphere gap connected across each capacitor and combined with a high-speed contactor, which automatically closes in case of a flashover of the protective gap, thus by-passing the unit during short-circuit conditions and restoring the capacitors to service when normal conditions are resumed.

The equipment was supplied by the General Electric

READINGS TAKEN ON FEB. 13, 1928

Condition of Line	33-Kv. Line Amp. at Ballston	33-Kv. Voltage at Spier Side of Capacitor (Rates 33,000/110)	Line Capacity as Utilized, Kva.
Capacitor out of circuit.....	33	122	2,000
Capacitor in circuit.....	67	126	4,200

Company and the advantages involved, according to T. A. E. Belt, are: Long-distance transmission of power at low voltages; marked increase in stability or power—carrying capacity of long lines; automatic voltage regulation without auxiliary regulating equipment; compensation for part of the reactance in a line so that it will share its proper division of load when paralleled with another line of widely different characteristics; reduction in expense of building, installing and maintaining regulating equipment as compared with synchronous machines, and the potentialities of the device for making possible rural lines now prohibitively expensive.

Cost of Coal Pulverizing Equipment

IN 1925 an Eastern central station installed various pulverizing apparatus in connection with a boiler plant betterment program. From the cost sheets on this job are printed the following data representing field costs in place for the groups of equipment items shown. Major overheads must be added in making complete estimates based on these figures, as the cost items given below do not include overhead charges.

COSTS OF MISCELLANEOUS COAL PULVERIZING EQUIPMENT (1925 JOB)

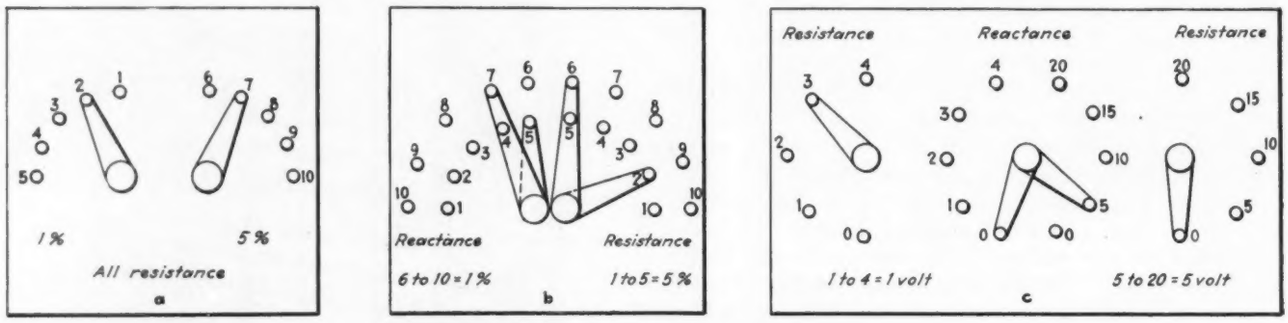
Drying System	
Six 900-sq.ft. Lopulco driers, complete with casing, framework, discharge hopper, air damper, internal steam piping connections, valves and traps.	
Three 3,000-cu.ft. per minute exhaust fans, Sturtevant special, driven by three 15-hp. motors, three-phase, 60-cycle, 550-volt, Westinghouse with control.	
Three drier collectors, 6 ft. diameter, No. 10 gage iron, with vent	$33,527
Mill System	
Three pulverizing mills, Raymond type, six-roll, direct-connected to three 200-hp. motors, three-phase, 60-cycle, 450-r.p.m., with control.	
Three blowers, driven by three 100-hp. motors, 1,200-r.p.m., with control.	
Collector piping, vents and piping from mills to screw conveyors	76,474
Screw Conveyors and Chutes to Coal Pumps	
Two 35-ton screw conveyors, 14-in. size, 50 ft. long, cast-iron type, with two discharge openings, slide gates, each driven by 20-hp., 550-volt, three-phase motor, with control, and	
Chutes from conveyors to coal pumps	6,578
Coal Pumps	
Two 10-in. Fuller-Kenyon coal pumps, type A, each driven by 75-hp., 2,200-volt, Westinghouse motor, 900-r.p.m., three-phase, 60-cycle, and control	12,829
Vacuum Cleaning System	
One Sturtevant horizontal size F vacuum cleaner, direct driven by 7½-hp., 550-volt, three-phase, 60-cycle motor with control; also primary and secondary dust receivers and separators, and piping	3,439
Air compressor and equipment	6,025
Contractor's compensation, 5 per cent	6,944

Computing Compensator Settings for Automatic Voltage Regulators

FIFTH ARTICLE

By V. W. Palen

COMPENSATOR SETTINGS.—In concluding this series of articles the compensators in general use and the methods of setting them are noted. The simplest unit is shown at *a*. It has two resistance adjustments, but no reactance adjustment. This type of compensator does not take into account the varying power factor as do the units shown in *b* and *c*. In using this device it is necessary to utilize a setting equal to the impedance. The contacts 6 to 10 are in steps of 5 per cent, which is equal approximately to 5 volts, while the contacts 1 to 5 are in steps of 1 per cent, which is equal approximately to 1 volt. Zero compensation is obtained by placing the contact arms on points 1 and 6. For the single feed described in the first article the contact arms would be put on points 2 and 7 to correspond approximately to the computed impedance drop of 5.190 volts obtained from the assumed data.



Compensator setting arrangements

All the compensators are shown set for the same values to illustrate the different characteristics of each. They are all set to compensate for the circuit described in the first article of this series.

A compensator having resistance and reactance adjustments is shown at *b*. Here again the points 6 to 10 are in 5 per cent steps, while the points 1 to 5 are in steps of 1 per cent. To set this compensator for the case described in the first article the reactance arms would be set on points 5 and 7 to correspond approximately to the computed reactance drop of 4.339 volts. The resistance arms, in turn, would be set on points 2 and 6 to correspond approximately to the computed value of 2.801 volts resistance drop.

One of the latest type compensators, similar to the one in *b*, except that the points 0 to 20 are in steps of 5 volts, while the points 0 to 4 are in steps of 1 volt, is indicated at *c*. To set this compensator for the case described in the first article the reactance arms would be placed on points 0 and 5, while the resistance arms would be placed on 0 and 3. This type compensator is advantageous as it may be read directly in volts and because the numbers on the points indicate at a glance what the setting is or should be.

It is sometimes stated that to prevent "hunting" of the regulators it is best to overcompensate slightly on cross-connected loops, but the experience of the author indicates, as the result of a number of experiments using both the exact and overcompensation methods, that either plan may be applied to the compensator settings with equally satisfactory results.

Calculating Short Lines

Certain limitations in use of circle diagram for lines under 25 miles long resulted in developing chart based upon vector diagram. Its application to Alabama system

By S. MURRAY JONES and JOEL TOMPKINS
Southeastern Engineering Company, Birmingham, Ala.

THE use of graphical methods in the solution of engineering problems is becoming increasingly popular. In studying a proposed plan, or in analyzing the action of existing networks, so many results are often desired that analytical methods become inadequate, because of the amount of time and labor involved. This is especially true in the case of power transmission line studies.

The desire for graphical methods of solution for transmission lines led to the development of the circle diagram by R. D. Evans and H. K. Sels, which diagram was described by them in the *Electric Journal* of December, 1921. This diagram has been found very useful, but has the disadvantage of being based on constant voltage at one end of the line, so several charts are necessary if operating conditions at various voltages are to be studied. A modified Evans and Sels chart was described by V. Bush and R. D. Booth in their paper on "Power System Transients" in the *Transactions* of the A.I.E.E. for 1925. This modified chart was applicable for any value of voltage at either end of the line, so that only two charts, one for the receiving end and one for the sending end, are required. A still further modification, used by Prof. C. G. C. Dahl of the Massachusetts Institute of Technology, makes the charts direct reading at the nominal voltage for which they are drawn.

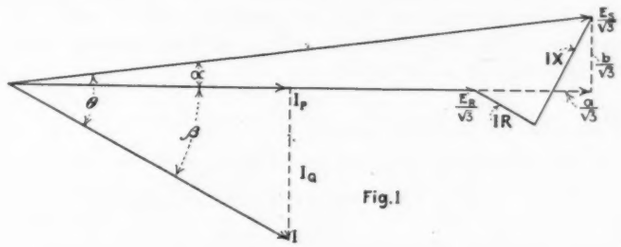
In this last-mentioned form the circle diagrams are extremely useful, especially for the treatment of long lines, where capacitance plays an important part. However, for electrically short lines, the capacitance of which may be neglected, circle diagrams cannot be conveniently used because circles of very large radii would be involved. In order to draw such diagrams the scale used would necessarily be so small that the chart would be useless. In making calculations on a system having many short as well as long lines it becomes desirable to have graphical means to handle the short lines as conveniently as do the circle diagrams the long lines.

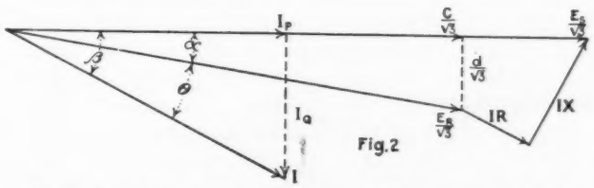
The transmission network of the Alabama Power Company consists largely, at the present time, of 110-kv. lines, some of which are shorter than 25 miles in length. Several of the links in the high-tension loop about the city of Birmingham are examples. The authors, in making calculations on the lines of the system, found the modified Evans and Sels chart useful on lines of length greater than 25 miles, but found it desirable to develop a different type of chart for the shorter lines.

The chart developed is based on the vector diagram of the line and on the assumption that the capacitance is negligible. For lines shorter than 25 miles the error involved is less than 1 per cent.

The quantities usually known or desired in a transmission line study are the sending and receiving end power and reactive kilovolt-amperes, or power and power factor, and sending and receiving end voltage. It was decided that the most convenient means of representing power conditions was by means of the power and reactive kilovolt-amperes, which is the method used in the Evans and Sels chart.

Consider the vector diagram shown by Fig. 1. Here E_R represents the receiving end voltage and will be taken as the axis of reference. I is the load current and β is





Figs. 1 and 2—Vector diagrams of lines for deriving transmission chart

the load power-factor angle. IR and IX are the resistance and reactance drops, respectively, in the line. E_S is the sending end voltage. E_S and E_R are line-to-line voltages.

The following equation may be written:

$$E_S = \left[\frac{E_R}{\sqrt{3}} + I(\cos\beta + j\sin\beta\right]\sqrt{3} \qquad (1)$$

Let

$$I(\cos\beta + j\sin\beta) = I_P + jI_Q \qquad (2)$$

where I_P and I_Q are the active and reactive components of current, as shown on Fig. 1. The angle β must be considered with its true algebraic sign, considering clockwise rotation positive.

Then

$$I_P = \frac{P_R}{\sqrt{3}E_R} \qquad (3)$$

$$I_Q = \frac{Q_R}{\sqrt{3}E_R} \qquad (4)$$

where P_R and Q_R are the total three-phase power and reactive kilovolt-amperes respectively at the receiver end. Q_R must be given the proper sign, positive for leading and negative for lagging.

The voltage E_S may be resolved into two components: One, a, in phase with E_R, and the other, b, in quadrature with E_R. Then equation (1) may be rewritten as:

$$E_S = a + jb = E_R + \frac{(P_R + jQ_R)(R + jX)}{E_R} \qquad (5)$$

The real and imaginary parts of equation (5) may be separated, giving:

$$a = E_R + \frac{P_R R - QX}{E_R} \qquad (6)$$

$$b = \frac{Q_R R + P_R X}{E_R} \qquad (7)$$

Equation (6) may be changed to:

$$E_R(a - E_R) = P_R R - Q_R X \qquad (8)$$

As a, in most cases, is practically always equal numerically to E_S, equation (8) represents an expression for E_R times voltage drop. This will be shown below in an actual example.

Also, from (7)

$$bE_R = P_R X + Q_R R \qquad (9)$$

$$\frac{b}{a} = \tan \alpha, \qquad (10)$$

as shown on Fig. 1.

To obtain expressions involving sending end power and kilovolt-amperes, the expressions below may be written. The subscript S refers to the sending end. As capacitance is neglected,

$$I_S = I_R \qquad (11)$$

Then the sending end power is

$$\begin{aligned} P_S &= \sqrt{3} E_S I \cos(\alpha - \beta) \\ &= \sqrt{3} E_S I (\cos\alpha \cos\beta + \sin\alpha \sin\beta) \\ &= \sqrt{3} E_S I \left(\frac{aIP}{E_S I} + \frac{bIQ}{E_S I}\right) \\ &= \frac{aP_R + bQ_R}{E_R} \end{aligned} \qquad (12)$$

In a similar manner,

$$\begin{aligned} -Q_S &= \sqrt{3E_S}\, I \sin(\alpha - \beta) \\ &= \frac{bP - aQ}{E_R} \end{aligned} \qquad (13)$$

Equation (12) may be simplified by using the values of a and b from equations (6) and (7). Then

$$\begin{aligned} P_S &= \frac{aP_R + bQ_R}{E_R} \\ &= P_R + \frac{P_R{}^2 R - P_R Q_R X}{E_R{}^2} + \frac{Q_R{}^2 R + P_R Q_R X}{E_R{}^2} \\ &= P_R + \frac{P_R{}^2 + Q_R{}^2}{E_R{}^2} R \end{aligned} \qquad (14)$$

Transposing,

$$P_S - P_R = \frac{P_R{}^2 + Q_R{}^2}{E_R{}^2} R \qquad (15)$$

This may readily be recognized as the familiar expression that power loss is equal to the square of the current times the resistance. Equation (15) may be rewritten as:

$$P_R{}^2 + Q_R{}^2 = \frac{E_R{}^2}{R} \times (\text{power loss}) \qquad (16)$$

Equation (13) may be treated in the same manner:

$$-Q_S = \frac{bP_R - aQ_R}{E_R}$$

$$= \frac{P_R{}^2 X + Q_Q{}^2 X}{E_R{}^2} - Q_R \qquad (17)$$

Then

$$Q_R - Q_S = \frac{P_R{}^2 + Q_R{}^2}{E_R{}^2} X \qquad (18)$$

This may be recognized as saying that the change in reactive kilovolt-amperes in a circuit is equal to the current squared times the reactance.

(19)

Construction of Chart

Voltage Relation.—Referring to equation (8), it may be seen that this represents a straight line for any one value for $E_R(a - E_R)$, with power and reactive kilovolt-amperes as co-ordinates.

$$P_R R - Q_R X = \text{Constant.} \qquad (20)$$

When $E_R(a - E_R)$ is zero, this line passes through the origin, and has a slope equal to the ratio of the resistance

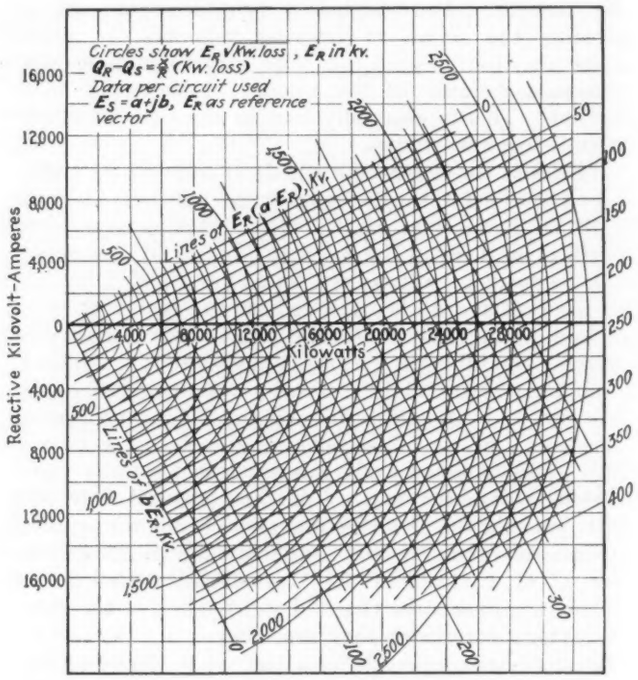


Fig. 3—Transmission chart for solving electrically short lines

This chart is for the 110-kv., 16.4-mile Leeds-Magella line of the Alabama Power Company. Conductors, No. 2/0 copper; mean spacing, 154 in.; circuits, two; ratio of X/R, 1.910.

to the reactance of the circuit. For other values of $E_R(a - E_R)$, a group of parallel straight lines may be drawn. Referring to Fig. 3, this is the group of lines sloping upward and to the right.

Also, equation (9) may be recognized as a family of straight lines, sloping downward and to the right, for constant values of bE_R, with a negative slope equal to the ratio of the reactance to the resistance. Hence, the second group of lines is at right angles to the first group.

Power Relations.—Equation (16) may be recognized as the equation of a circle whose center is at the origin, and whose radius is equal to $E_R\sqrt{\frac{\text{Power loss}}{R}}$. A family of concentric circles may be plotted so that $E_R\sqrt{\text{Power loss}}$ may be read directly. These circles are also shown on Fig. 3.

A similar set of circles for the reactive power change might also be drawn, but this is not necessary, as from

a comparison of equations (15) and (18), it may be seen that

$$(Q_R - Q_S) = \frac{X}{R}\,(\text{Power loss}) \qquad (21)$$

Use of Chart.—Fig. 3 was drawn for a 110-kv. line, 16.4 miles long, with reactance of 13.79 ohms and a resistance of 7.22 ohms. The chart is drawn so that voltages are read in kilovolts and power in kilowatts. Loss is also read in kilowatts. Three-phase values are used throughout.

To best show the use of the chart, an actual example will be worked. Assume the load to be 24,000 kw. with a reactive component of 8,000 kva. lagging. Assume the receiving end voltage as 110 kv. This point may be spotted on the chart. Then the value of $E_R(a - E_R)$ may be read as 273. Then

$$a - E_R = \frac{273}{110} = 2.48 \qquad (22)$$

$$a = 2.48 + 110 = 112.5 \text{ kv.} \qquad (23)$$

For all practical cases, a is equal to the sending voltage, as shown below.

The value of bE_R may be read as 282, so that b is equal to 2.56 kv. Then the sending end voltage, referred to the receiving end voltage,

$$E_S = a + jb = 112.5 + j2.6 \qquad (24)$$

To find the magnitude of E_S it has been found convenient to use a short-cut method. The binomial theorem states that

$$(x+y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{2.^1}x^{n2}y^2 + \ldots\ldots \qquad (25)$$

For the quantity $\sqrt{a^2 + b^2}$ this becomes:

$$(a^2 + b^2)^{\frac{1}{2}} = a + \frac{b^2}{2a} - \frac{b^4}{6a^3} + \ldots\ldots \qquad (26)$$

When b is less than one-third of a, all terms beyond the second may be neglected as they have very little effect on the accuracy of the results. Then for all practical purposes, when b is less than one-third of a,

$$\sqrt{a^2 + b^2} = a + \frac{b^2}{2a} \qquad (27)$$

Substituting the values obtained above,

$$E_S = 112.5 + \frac{(2.6)^2}{225} = 112.5 + 0.03 = 112.5 \qquad (28)$$

It may seem that the value of b has practically no effect on the magnitude of E_S. Hence, if only the magnitude of E_S is desired, it is not, as a general rule, necessary to determine b.

However, if it is desired to get the angle of E_S with respect to E_R, it is necessary to obtain the value of b.

From the loss circles, the value of 2150 may be read. Then,

$$\sqrt{\text{Loss}} = \frac{2150}{110} = 19.5 \qquad (29)$$

The loss is 380 kw. Then the sending end power will be 24,380 kw. As the ratio of reactance to resistance for the line considered is 1.910, the change in reactive kilovolt-amperes is $Q_R - Q_S = 1.910 \times 380 = 730$ kva. (30) Then the sending end reactive kilovolt-amperes is

$$Q_S = -8{,}000 - 730 = 8{,}730 \text{ kva.} \qquad (31)$$

The sending end kilovolt-amperes is

$$P_S + jQ_S = 24{,}380 - j\,8{,}730 \qquad (32)$$

It should be borne in mind that this quantity is referred to the sending end voltage as a reference vector, as may be seen from a study of the derivation of the formulas for the chart, so that actual sending end conditions are shown by the chart.

It may be seen that results may be obtained that are more accurate than generally required. The chart may be read very quickly, simply taking the value for $E_R(a - E_R)$ and of the loss circle at the nearest even value, and the results will be sufficiently accurate for all practical purposes. The chart, when used in this way, may easily save a large amount of time when many calculations are to be made on a short line.

Sending End Charts.—A very convenient feature of the chart described above is that it may be used as a sending end chart to find receiving end conditions directly. Let E_S be used as an axis of reference, and let

$$E_R = C + jd \qquad (33)$$

All other quantities may be used as above. Referring to Fig. 2, by proceeding as above, the following expressions may be derived:

$$E_S(E_S - C) = P_S R - Q_S X \qquad (34)$$

$$-dE_S = P_S X + Q_S R \qquad (35)$$

$$P_S^2 + Q_S^2 = \frac{(P_S - Q_R)E_S^2}{R} \qquad (36)$$

$$P_S^2 + Q_S^2 = \frac{(Q_R - Q_S)E_S^2}{R} \qquad (37)$$

It may be seen that if P_S and Q_S are used instead of P_R and Q_R, the quantity $E_S(E_S - C)$ may be read instead of $E_R(a - E_R)$ on the receiving end chart. The real component, C, of the receiving end voltage may thus be determined, when E_S is known. Similarly, the quadrative component, d, may be determined. In this case, d must be taken with the negative sign, as shown by (35) and by Fig. 2. Obviously the same loss circles may be used when sending end, instead of receiving end, conditions are given. (Equation 34.) The change in reactive kilovolt-amperes may be found in the same way. It may be seen that the same chart may be used both as receiving and sending end diagrams.

Correction of Reactive Kilovolt-Amperes for Capacitance.—Although, for a short line, capacitance has practically no effect on voltage and power loss, it may be found desirable in some types of problems to include the effect of capacitance on the change in reactive kilovolt-amperes. This may be done approximately by finding the change in reactive kilovolt-amperes, as outlined above, and then adding the kilovolt-amperes that would flow through a condenser of capacitance equal to that of the line. This is equivalent to assuming that all the capacitance is lumped at one end of the line. Care must be used in fixing the various algebraic signs. In problems in which the reactive kilovolt-amperes is desired with accuracy it may be necessary to make this correction.

"Electrical World" Index Available

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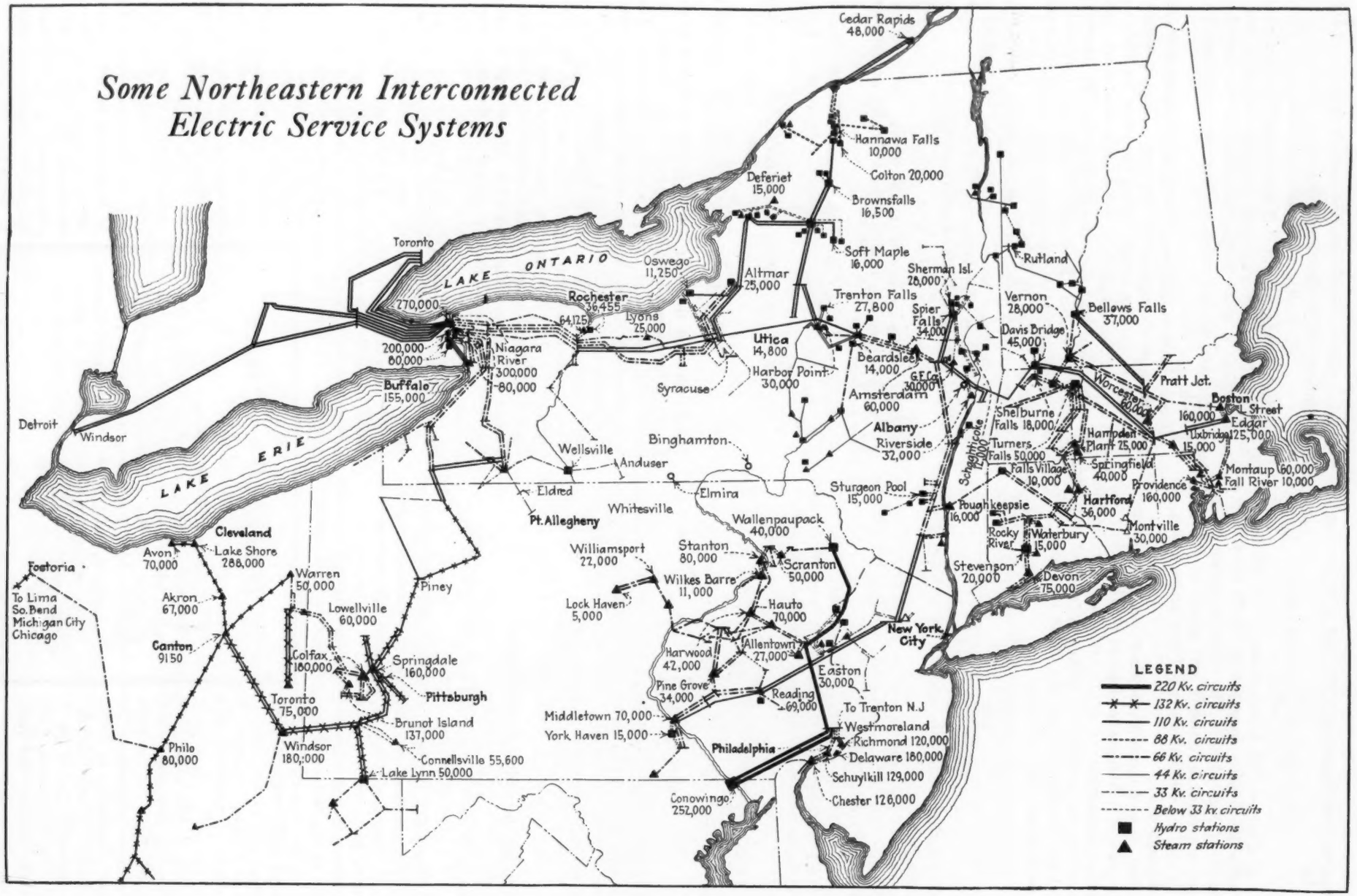


All the systems shown operate in parallel

Selection of
Potential Transformer Ratio

Analysis of problem for 24-kv. system. Determination of 210 to 1 ratio with secondary voltage of 125 shown to be best solution for conditions prevailing in Boston practice

By WELLEN H. COLBURN
Electrical Engineer with the Edison Electric Illuminating Company of Boston

DURING the planning of the main distribution substation (Roslindale, No. 13) for the 24-kv. system of the Boston Edison Company an interesting problem in the selection of the ratio for the potential transformers developed. This arose from the use by this company of the secondary scale as a general standard for all voltmeters used with potential transformers.

It is not the purpose of this article to discuss the merits of voltmeter scale calibration in primary versus secondary potential transformer volts, but as the governing consideration in the particular problem presented is concerned with the scale reading of the voltmeter it is well at the outset to review some of the advantages of the use of the secondary scale which made a departure from the standard undesirable even in this case:

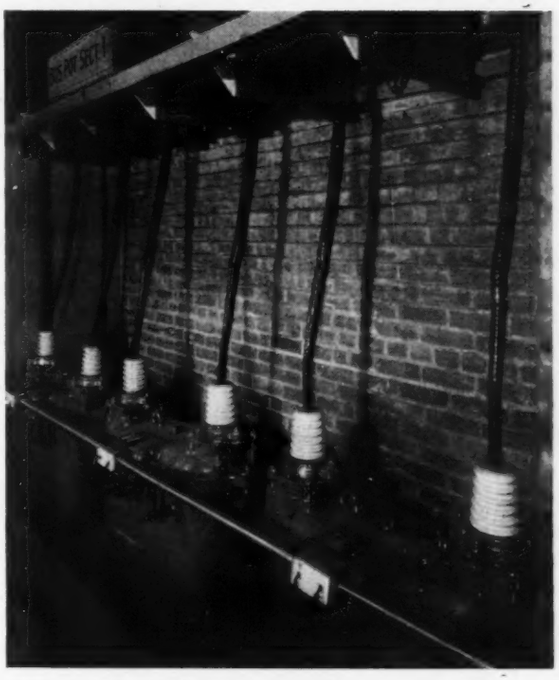
1. It is recognized that the pressure for service to residential lighting and small power customers has been largely standardized at 115 volts. Therefore a voltmeter applied at any point on the low-tension service network should read approximately 115. Of course it cannot be expected that exactly 115 volts can be maintained for each customer along the entire length of a long distribution circuit, but that is the standard which is expected for the average voltage of the circuit.

2. Using this pressure as a standard of reference, transmission, distribution and other service voltages have been established at multiples thereof, listed in part in the accompanying table.

STANDARD POTENTIAL TRANSFORMER RATIOS
Service, Distribution and Transmission Voltages Based on 115-Volt Service Standard

Voltage Classification	One Phase or Three Phase Delta	Three Phase Y Nominal	Potential Transformer Ratios One Phase or Three Phase Delta or Three Phase Y to Neutral	Three Phase Y, Phase to Phase
Service	115	.....	.....	.....
	230	.....	.....	.....
	460	.....	.....	.....
	575	.....	.....	.....
Distribution	1,150	.....	10/1	.....
	2,300	3,980	20/1	(35/1)†
	4,600	.....	40/1	.....
Transmission	6,900	12,000	60/1	100/1
	11,500	20,000	100/1	.....
	13,800	*24,000	120/1	200/1
	23,000	40,000	200/1	.....
	27,600	48,000	240/1	400/1
	34,500	60,000	300/1	.....
	46,000	80,000	400/1	.....
	69,000	120,000	600/1	1,000/1
	115,000	200,000	1,000/1	.....

* Adopted by the Edison Electric Illuminating Company of Boston for new transmission system.
† Used by the Edison Electric Illuminating Company of Boston.



Bus potential transformers at Roslindale

3. Although some of these voltages may be read directly, while others for safety's sake must be obtained by the intermediation of a potential transformer with either primary or secondary scale for the instruments, nevertheless where several levels of voltage are used for transmission, distribution and other service there appears an immediate advantage in making all readings in terms of the service standard so that the system operator can readily correlate his data and regulate his various system voltages to that standard without consideration of the operating voltage.

CALIBRATION IN SECONDARY VOLTS DESIRABLE

Thus it proves desirable for the Boston Edison system for all voltmeters used with potential transformers to be calibrated in secondary volts. The normal operating point then becomes 115 for the 2,300-volt delta or to neutral, 3,980-volt Y distribution, and the 6,900, 13,800, 24,000, 69,000 and 115,000-volt systems.

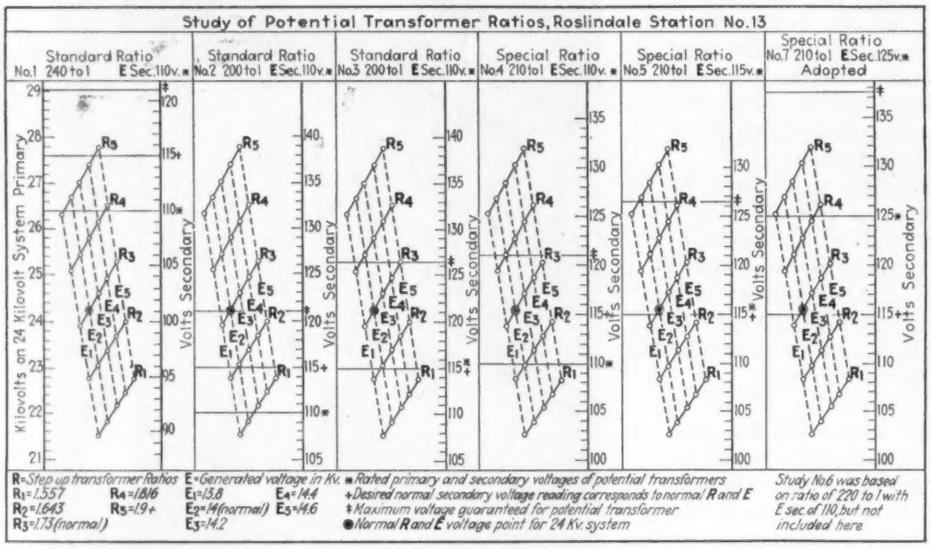
Potential transformers are usually rated on the basis

of a multiple of 110 or 115 volts and are guaranteed for 10 per cent primary overvoltage. In the case of long regulated distribution circuits the voltage at the station often exceeds even this allowance. In consequence, one maker, at least, lists a 2,500-volt potential transformer based on a multiple of 125 volts, and now supplies transformers of even higher rated voltage (3,000) with induction regulators, although retaining the ratio of 20 to 1, thereby giving a secondary voltage rating of 150. Among the standard ratios are those given in the table. If advantage is taken of the two secondary voltage ratings of 110 and 115 obtainable with these ratios many combinations are possible.

The initial selection of a ratio for the bus transformers at Roslindale was based on the nominal system voltage of 24 kv. and indicated a ratio of 240 to 1. However, a short but detailed study soon indicated the unsuitableness of this ratio.

The transformers at the Charles Leavitt Edgar generating station, described in some detail in an article in the Oct. 22 issue, entitled "Serving Large Power Blocks with 24-Kv. Feeders," have tapless 14,000-volt delta windings on the low-tension or generating side and are connected Y and tapped for 26,642, 25,431, 24,220, 23,009 and 21,798 volts on the high-tension side. Seasonal bus voltage variation at this station has a range from 14,000 to 14,600, well within 10 per cent. However, with the range of taps available this results in a possible voltage range of from 21,798 to 27,784, or 27½ per cent, on the bus at Roslindale. This takes no account of rise in voltage at very light loads over the long cables, which may in some instances amount to as much as 2½ per cent.

Accordingly, study was made of the most suitable ratio to bring the bus voltage within the 10 per cent overvoltage guarantee of the potential transformer and yet to give a normal secondary voltage reading of 115. The accompanying series of graphic charts was prepared, which indicated that a ratio of 210 to 1 with a secondary voltage rating of 125 was the most suitable. There was already a precedent for the 125-volt secondary in the standard 2,500 to 125-volt ratio 20 to 1 potential transformers, but the desired ratio was between standards. However, confirmation of this ratio was afforded in that it is exactly three times the 70 to 1 ratio of the Y-connected, isolated-phase potential transformers used in the Edgar station, a result to be expected from the consideration that the 24-kv. system voltage is the Y voltage corresponding to the 13,800-volt delta system whose voltage to neutral is read on the voltmeters (with secondary voltage scales) at that station.


Study of Potential Transformer Ratios, Roslindale Station No.13
Standard Ratio No.1 240 to 1 E Sec. 110v.*
Standard Ratio No.2 200 to 1 E Sec. 110v.*
Standard Ratio No.3 200 to 1 E Sec. 110v.*
Special Ratio No.4 210 to 1 E Sec. 110v.*
Special Ratio No.5 210 to 1 E Sec. 115v.*
Special Ratio No.7 210 to 1 E Sec. 125v.* Adopted
Kilovolts on 24 Kilovolt System Primary
Volts Secondary
R=Step up transformer Ratios
R1=1.557 R4=1.616
R2=1.643 R5=1.9+
R3=1.73 (normal)
E=Generated voltage in Kv.
E1=13.8 E4=14.4
E2=14 (normal) E5=14.6
E3=14.2
*Rated primary and secondary voltages of potential transformers
†Desired normal secondary voltage reading corresponds to normal R and E
‡Maximum voltage guaranteed for potential transformer
●Normal R and E voltage point for 24 Kv. system
Study No.6 was based on ratio of 220 to 1 with E sec. of 110, but not included here

Potential transformer characteristics analyzed and evaluated by charted data

The geometrical figures in the chart show the range of voltages on the 24-kv. system predicted from the generating station voltage range and the step-up transformer ratio. The charts show what ratio of potential transformer will bring the 115-volt secondary line marked (†) closest to the normal point (24,220 primary volts) of the 24-kv. system and what primary and secondary voltage rating, marked (*), will afford a safe margin in primary voltage guarantee (110 per cent of the primary rating), marked (‡), to maintain the expected 24-kv. system maximum. These conditions are shown to be satisfied only by transformer No. 7.

Special Calibration Unnecessary

Although it was recognized that with the use of the standard 115-volt ratio 240 to 1 transformers the desired result, so far as voltmeter reading was concerned, could be obtained by special calibration of the instrument, such procedure was open to serious objection in that not only would it make special calibrations necessary in periodic checking of the instruments but also the actual voltage could not be calculated readily from voltmeter readings should this be required. The 210 to 1 ratio obviated all these objections and was therefore selected. With a secondary rating of 125 volts the primary rating thus was 26,250 volts, which, with the 10 per cent overvoltage guarantee, gives a maximum voltage of 28,875 volts, safely above the anticipated maximum. In addition, the normal operating voltage of 24,220 brings the meter reading very closely to 115.

No less important than the ratio were the physical dimensions of the transformers. The space available for the switch structure, while ample in area, was so restricted by columns and in height as to make minimum size a controlling factor. The transformers selected were of Westinghouse manufacture.

As was to be expected, several amusing, if annoying, occurrences have arisen from the selection of an off-standard ratio in that the manufacturers seem to have great difficulty in comprehending that wattmeters and watt-hour meters are in reality to be scaled or supplied with gear trains for a ratio of 210 to 1 rather than one of the standard ratios.

The "proof of the pudding," however, lies in the fact that the voltage readings for the 24-kv. bus are "normal," as at any other point on the system, and no operating inconvenience results, for this system is treated and looked upon exactly as any other. Such a result, coupled with the assurance of ample rating of the equipment to meet the most exacting conditions of service, justifies departure from existing equipment standards.

Circuit Breakers Used on Residence Installations

By W. L. Wadsworth
Superintendent Meters Northern States Power Company, Minneapolis, Minn.

WORKING in conjunction with the electrical inspection department of the city of Minneapolis, the Northern States Power Company made an installation where no fuses were installed in the entire house. In looking over the market for circuit-breaker devices we were confronted with a lack of these devices which could be readily installed and used with the watt-hour meter.

We soon came to the conclusion that it would be necessary for us to use a standard type of breaker which was on the market and adapt it for use on this installation. Standard U-Re-Lite circuit breakers were modified slightly in our shop so that they could be used to conform to our standard installation. This consisted of the tying together of the two outside legs of the circuit breaker so that if a short occurred on one side of the three-wire system it would trip out the other side at the same time. Some further changes were the removal of the breaker in the neutral and the insertion of a solid copper strip and some changes in the upper part of the cabinet so that it would fit our safety type of sealed end wall. The changes are of no consequence in application of the circuit-breaker idea.

Circuit breakers for the branch circuits were obtained from the R. H. Maple Company.

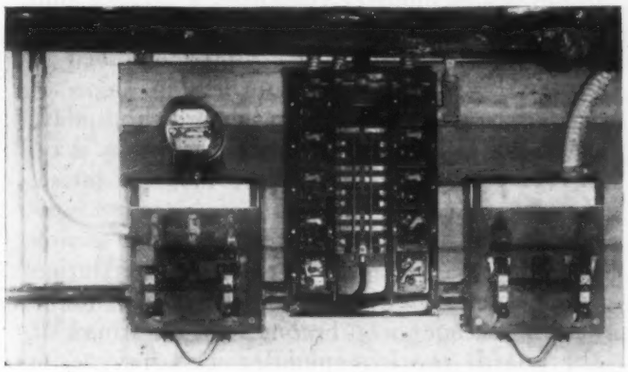
In making this installation we endeavored to keep in mind that one of the essential things for the adoption of the breaker in place of fuses would be the cost of the apparatus. We soon found that the cost of the present development of the breaker would be prohibitive as to its universal adoption and we came to the conclusion that the installation should be made in order to obtain some data on the operation of these circuit breakers with the hope that if they proved satisfactory the manufacturers would develop a breaker where the cost would be competitive with the fuse installation.

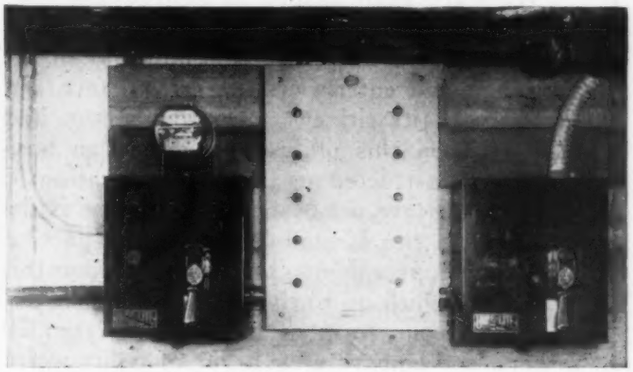
The circuit breakers on this installation consist of one 80-amp. capacity time lag magnetic circuit breaker for the service entrance and one 60-amp. magnetic breaker for the electric range protection and a ten-circuit cabinet with a 15-amp. capacity breaker installed on one leg of each circuit. The magnetic type is used in the light circuit and the thermostatic in the power circuits. It is interesting to note that this residence has a bare neutral wire which is grounded at each outlet.

TESTS ON BRANCH CIRCUIT BREAKERS

Circuit No.	Amp.	Amp.
1	Coil circuit breaker holds at 15.2	Opens at 15.6
2	Coil circuit breaker holds at 16.4	Opens at 16.5
3	Coil circuit breaker holds at 19.5	Opens at 20.0
4	Coil circuit breaker holds at 18.1	Opens at 18.5
5	Time limit breaker opens at 30 amp in 28 seconds, opens at 38.2 amp. in 12.2 seconds.	
	Amp.	Amp.
6	Coil circuit breaker holds at 16.1	Opens at 16.5
7	Coil circuit breaker holds at 14.8	Opens at 15.0
8	Coil circuit breaker holds at 15.2	Opens at 15.5
9	Coil circuit breaker holds at 15.5	Opens at 16.0
10	Opens at 35 amp in seven seconds due to heat of previous load. After being allowed to cool No. 10 circuit breaker opens at 35 amp. in 13.5 seconds.	

The results of the tests on these branch circuit breakers are shown in the accompanying table. Circuits Nos. 5 and 10 have time limit breakers installed on them and are used for appliances such as oil burners, garage door openers, dishwashers, etc., or such apartments where the starting current is considerably higher than running current. It is particularly interesting to note in the tests of branch circuit breakers the closeness with which they can be adjusted to operate under load. These circuit breakers have now been in service for about six months and have never failed to operate due to overload or short circuit and with no apparent damage to the circuit breakers.





Circuit breakers installed on service entrance, range circuit and ten lighting circuits. The two views show cabinets closed and with covers removed

Saves Time Cutting Flexible Leads

IN THE manufacture of a large number of magnet coils thousands of 6-in. flexible terminal leads were required. These leads were measured and snipped off, one by one, until the adoption of the following scheme, which speeded up the work enormously, according to Dexter W. Allis of Everett, Mass.:

A piece of $\frac{3}{4}$-in. maple, $2\frac{1}{4}$ in. wide by 30 in. long having a dowel 2 in. long cut at one end and a center depression made in the other end, was sawed lengthwise along one edge to such a depth that a thin strip of sharp-edged steel 28 in. long would, when inserted into the saw slot, knife-edge out, protrude $\frac{1}{4}$ in. from the channeled surface of the wood.

The board, fitted with its steel blade, was placed in a lathe and wound with a layer of terminal wire. It was then removed and the wire cut into lengths by being struck with a mallet along the cutting edge.

*A New Competition**

By PHILIP H. GADSDEN
Vice-President
United Gas Improvement Company

THERE is a new competition which threatens American business at this time. To meet this new competition the traditions of 150 years, the experience and training of American business, have left us totally unprepared. I refer to competition by the federal government—the increasing efforts to inject the federal government into the field of business.

We have been taught to believe that our government was established to insure a free field and a fair contest for the interplay of the initiative and enterprise, the self-reliance and industry of its citizens. On this theory and relying upon this philosophy, American business has constructed an amazing civilization.

But signs are not wanting that there is developing in the United States on the part of certain groups a demand that we abandon this principle, which up to the present time has distinguished our form of government from all others, and embark upon a line of policy which would sap and undermine that initiative and enterprise which is characteristic of us as a people. In this new competition there can and must be no compromise. It is a war to the end.

There are two distinct schools of political thought in this country today. It is a conflict of two utterly antagonistic ideas—a struggle for supremacy between a thinly disguised socialism and the traditional policy that has enabled this country, in a century and a half, literally to amaze the world with its economic and social progress. It is the struggle between private ownership and government ownership.

THE issue is squarely presented—shall government confine its activities to the political field and leave business to the initiative and enterprise of its citizens? If the government enters into any industry, private capital, proverbially timid, will retire from it.

The only thing which can shake the credit and disturb the progress of our industrial development is the menace of government competition.

Let me direct your attention for a moment to a little-discussed phase of this aspect of the question. Much has been said from the viewpoint of the public's right to efficient service and from the viewpoint of private management and stockholdership, but little has been said from the viewpoint of the employee.

The great army of employees of private business and industry constitute a large group of the public. The rights and interests and welfare of the employees are vitally involved in proposals for government ownership.

Under private ownership the lad who, today, enters an establishment as an errand boy may, in future years, become the head of the house, if he has it in him. The epic of American business is full of such achievements—the section hand, the station agent in the lone way station who becomes the president of the railroad; the bank messenger who becomes the chairman of the board; the iron puddler who becomes a dominant leader in steel; the grocer's clerk who becomes the presiding genius of a nation-wide chain of mercantile establishments—and so on.

DOES government ownership spur the ambition and initiative of the employee?

Not at all. In government, preference goes either by political favoritism or a rule of seniority that takes little or no account of merit and discounts initiative. Imagine the power industry of the United States, for example, in the hands of employees whose proper ambitions are thus shackled—or the railroads, or the steel mills, or any great agency of business!

Mass production by the government means higher and not lower unit costs, frozen wage scales and stationary instead of advancing standards of living.

President Coolidge officially and convincingly voiced a policy when he said:

"If it is desirable to protect the people in their freedom and independence, if it is desirable to avoid the blighting effects of monopoly, . . . we shall leave the conduct of our private business with the individual, where it belongs . . ."

**Excerpts from address before International Advertising Association.*

*Also a "Trust"**

By M. S. Sloan
President Brooklyn Edison Company

THE present drive against the so-called electrical trust is the result of imperfect acquaintance with the basic facts regarding this industry, shallow thinking and bad economics. Disguise the fact however they choose, those behind this drive seek just one thing—to put the government, in as great a degree as seems possible, into the electrical industry. Credit them with the highest motives, and they will still be, in my opinion, a menace to the lasting welfare, prosperity and progress of our country. They would establish a real, a dangerous electrical trust. President Coolidge in a recent speech told us how. "When the government," he said, "once enters a business it must occupy the field alone. No one can compete with it. The result is a paralyzing monopoly."

Put the government into the power business at Boulder Canyon, at Muscle Shoals, on the St. Lawrence, on the Columbia River, as has been proposed, and you have the beginning of a process which cannot benefit either the government as the representative of our people or our people themselves. It hamstrings American initiative. It cuts the heart out of the system which has produced our present electrical industry.

PRESIDENT COOLIDGE said no one can compete with government. That is true—not because, in this case of the electrical industry, power companies could not obtain as good results, but because conditions of competition would inevitably favor government against any private business interest. Public utilities pay taxes—an average of at least 10 cents in the dollar of gross revenue. Government pays none. Public utilities have to go into the money market for capital and get it at the market rate. Government in business in the last resort has for its capital tax resources which are within its control. Public utilities must be run as a business—they must pay their own way. We know how government in business pans out—we have the example of the railroads and shipping, to mention only two outstanding instances.

Put the government into business on any large scale and it becomes almost impossible to get it out again. It is much more likely to extend itself until it drives out all private initiative in that field and becomes a paralyzing monopoly which the President described. The collapse of government operation of railroads was so spectacular that there had to be a withdrawal. But withdrawal from the field of shipping has been postponed year by year and still seems far off, while the losses continue to mount into the millions annually. Do we want to have this repeated in the electrical field?

THIS, it seems to me, is not a question for my industry alone, nor for all the individuals and institutions which by ownership of its securities have become interested in that industry. It is a question for every American business man, every straight-thinking citizen, for, as Mr. Green has said, this industry touches very closely every industrial establishment. It touches every American home.

In this country we have lived freer from government invasion of business than have other nations. We have, as a people, worked out our own salvation under the proper functioning of government, which is to assure equal opportunity and a square deal for all—to see to it that neither individuals nor corporations, in pursuing their rights, infringe on the rights of others. That freedom to make the most we can of ourselves, to labor and within the law have the results of our labors, is our proudest and most valuable heritage. If it is infringed, broken down to any degree, in the business of one, what protection have others? If in the business I represent, why not in your business—ultimately in most businesses or all business?

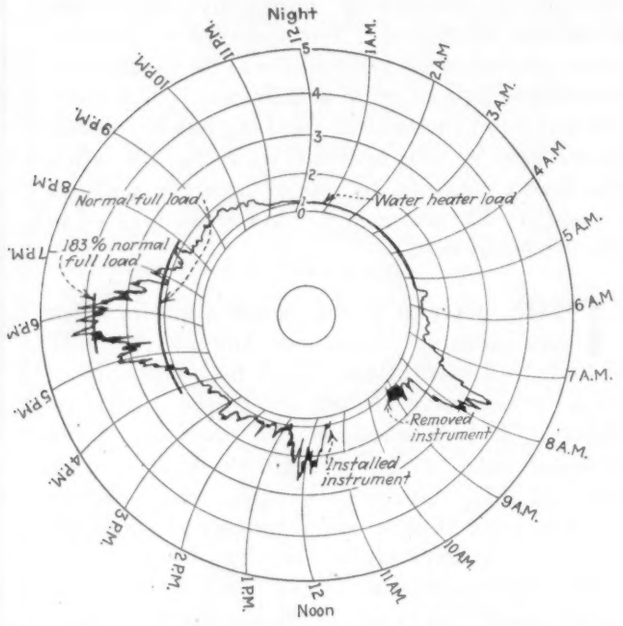
It seems to me we have a basic principle in question here—an issue which transcends in importance the effect on the particular business in the case. That issue is whether we are going to depart deliberately from the road on which we have been traveling, which has led us to our high place as a nation.

**From an address delivered before the Cleveland Advertising Club.*

Range Peaks Require Higher Transformer Fusing

By C. T. Hurd
Assistant Engineer Distribution Department, Portland Electric Power Company, Portland, Ore.

RAPID increase in the use of electric ranges has made necessary many changes in distribution practice of electric service companies. Ranges impose short but severe peaks on lines, transformers and other equipment which must be large enough to carry these peaks and yet capital cost and earnings must be taken into consideration. A comparatively small matter—the fusing schedule for distribution transformers—gave the Portland Electric Power Company considerable trouble.



Typical load on transformer supplying electric range load showing high peaks of short duration

During the past few years it has been found that the number of outages due to failure of transformer primary fuses has been far in excess of those to be expected from overload alone, and accordingly an investigation was made to determine the cause. The fusing schedule in effect prior to 1927 allowed approximately 250 per cent of transformer rating as the value at which a fuse was expected to blow. Bare hard-drawn copper wire in sizes ranging from No. 34 to No. 16 B. & S. gage was adopted as a fusing substance by this company in 1918 due to the fact that it is inexpensive, easy to handle, less liable to injury than a softer fuse wire, less susceptible to oxidation than alloys previously used and fairly uniform in quality.

It was found that in the majority of cases where transformer fuses failed, if they were re-fused with the same size of wire the transformer was able to give satisfactory service and upon test was found not to be severely overloaded. Recording ammeter tests on some of these transformers showed that they were not carrying excessive overloads at any time, but due to the short peaks caused by electric ranges some of them carried as much as 175 per cent and even as high as 200 per cent of full load for short periods, not long enough, however, to be dangerous to the transformer or even heat the oil excessively. A typical load chart is shown in the accompanying illustration.

Further investigation showed that many of the fuses gave evidence of oxidation and scaling due to heat, the resultant cross-section being somewhat smaller than the original wire, and eventually these fuses would blow at current values less than intended. Tests were then made on copper fuse wire to determine the point at which the scaling process would begin and some very definite values were arrived at. These are given in Table I. These values showed that some of the peaks experienced under ordinary operation were in excess of the oxidation point and that oxidation was the cause of the trouble. Accordingly the accompanying fusing schedule was adopted allowing approximately 350 per cent instead of 250 per cent full load current rating of transformers.

The result of this change reduced the number of service outages approximately 80 per cent. The number of burned up transformers caused by overload does not seem to have increased and the fuse protection now in effect seems to be as effective in cases of short circuits on secondary lines as it was before.

TABLE I—TEST DATA ON COPPER FUSE WIRE UPON WHICH TRANSFORMER FUSING SCHEDULE WAS BASED

Size of wire	26	24	22	19	16
Diameter of sample, in.	0.0160	0.0198	0.0252	0.0360	0.0506
Begins to oxidize, amperes	12	14	20	41	70
Oxidizes rapidly, amperes	14	16	24	45	80
Red in daylight, amperes	16	20	30	50	90
Cherry red, amperes	18	24	36	58	100
Fuses	20.6	27.7	40	67	107.5
Fusing current (N.E.L.A. Handbook)	20.6	28.9	41.2	66.7	117
Arbitrary rating adopted by Portland Electric Power Company in 1918	16.85	23.6	33.7	54.5	.....

TABLE II—DISTRIBUTION TRANSFORMER FUSING SCHEDULE USING COPPER WIRE ADOPTED BY PORTLAND (ORE.) ELECTRIC POWER COMPANY

For 2,400 and 4,150-volt distribution. Two transformers in open delta, three transformers in "Y" or two transformers in open "Y" fused same as single transformer.

	Single Transformer				Three Transformers in Closed Delta			
Trans. Size, Kva.	Full Load Primary Current	Size Copper Fuse Wire, No.	Current Rating Fuse	Per Cent of Rated Load	Full Load Primary Current	Size Copper Fuse Wire, No.	Current Rating Fuse	Per Cent of Rated Load
1.5	0.63	34	4.25	675	1.09	34	4.25	390
2.0	0.83	34	4.25	512	1.44	34	4.25	296
2.5	1.04	34	4.25	409	1.80	32	6.02	334
3.0	1.25	34	4.25	340	2.16	30	8.5	394
5.0	2.08	30	8.5	385	3.60	26	16.85	467
7.5	3.12	28	12.0	407	5.40	24	23.6	436
10.0	4.16	26	16.85	405	7.20	23	28.2	390
15.0	6.25	24	23.6	378	10.80	*22	33.7	312
20.0	8.30	23	28.2	339	14.4	*50A	50.0	347
25.0	10.40	*22	33.7	324	18.0	*19	54.5	303
25.0	10.40	*30A	30.0	288	18.0	*50A	50.0	277
30.0	12.5	*40A	40.0	320	21.6	†75A	75.0	347
37.5	15.6	*40A	40.0	256	27.0	†75A	75.0	278
50.0	20.8	*50A	50.0	240	36.0	†100A	100.0	278
75.0	31.2	†75A	75.0	240	54.0	†150A	150.0	278
100.0	41.6	†100A	100.0	240	70.4	†150A	150.0	213
150.0	62.5	†125A	125.0	200	108.0	‡200A	200.0	185
Three-Phase Transformers, 2,400 Volts					Three-Phase Transformers, 4,150 Volts			
3.0	0.73	34	4.25	580	0.42	34	4.25	1,010
5.0	1.20	34	4.25	354	0.70	34	4.25	607
10.0	2.40	30	8.50	354	1.39	32	6.02	432
15.0	3.60	26	16.85	467	2.1	30	8.5	405
25.0	6.00	24	23.60	393	3.47	28	12.0	356
37.5	9.00	*23	28.2	313	5.20	26	16.85	324
50.0	12.00	*22	33.7	280	6.92	24	23.6	341

Current rating of copper fuse wire based on given specified conditions.
*Throttle fuse, Cat. P. 46 C5, using L-M fuse links.
†G. E. Exp. Fuse Cat. No. 260277, using G. E. fuse links.
‡D. & W. Oil Fuse Cat. 230001, using fuse links.
For mechanical reasons, no wire smaller than No. 34 is to be used.

The Engineer and His Fellowmen

R. F. Schuchardt

An Interview with

R. F. SCHUCHARDT

President-elect of the American Institute of Electrical Engineers

Of the 41 presidents who have served the Institute during its 41 years of existence, R. F. Schuchardt belongs to that small group—not over three or four—of strictly electric light and power utility men. The rest of the leaders of the Institute have come from the ranks of educators, research scientists, or other than light and power utilities.

From the time of his graduation from the University of Wisconsin in 1897, Mr. Schuchardt has been an electric utility man. Practically his whole service has been with the Commonwealth Edison Company of Chicago and its predecessors, in which organization he started as a substation operator and climbed to the place of chief electrical engineer, which position he now holds.

Mr. Schuchardt has some very definite ideas on the relation of engineers to the world that surrounds them. Since the importance of the subject has been emphasized by several leaders in the electrical industry of late, Mr. Schuchardt's opinions have been sought and are briefly presented here.

WHEN asked recently for some of his views on the relation of engineers to their fellowmen, R. F Schuchardt, electrical engineer of the Commonwealth Edison Company, quoted a magazine characterization of Herbert Hoover which read: "Merely an engineer with an excellent mind and great gifts as an executive." He asked, "Why does this characterization include the deprecatory phrase 'merely an engineer'?"

Engineers Overlook Social Values of Their Accomplishments

"Taking it, as it truly is, as an arraignment of all of the engineering professions, the phrase is often justified. Engineers in general are too much occupied with the work they are doing and too little occupied with the effect of that work on the general public. In their preoccupation with the economic and material forces of civilization they frequently overlook the social forces that are always just as important and frequently more important.

"This is not to say that the engineer who possesses any vision at all does not appreciate the effect of his work. He may even conceive of the effect in social as well as economic terms. But so often as to make exceptions remarkable, he makes no effort to interpret the engineering accomplishment in terms easily understandable to the average mind.

"In those concerns that are outside his daily occupations to keep his family clothed, housed and fed the average citizen is at best a rather superficial thinker. His opinions are less the result of ordered and informed thought than they are reactions from impressions received from daily contacts and from reading the newspapers.

"If the engineer is too busy to make the required effort to reach the public mind—and it is real effort; if he cannot or will not translate his technical jargon into everyday speech; then he should not quarrel with the classification that sets him apart as 'merely an engineer,' something different from the rest of mankind.

"If engineers, in their extra-professional contacts and even when speaking among themselves within the confines of their own sacred groves, will consider more the human purposes of their work and will express those purposes in easily understandable form, the popular idea of the engineer as a narrow gage materialist will decline and the public will regard him as a human being.

An Interpretation of Engineering Needed in Terms of Service to Humanity

"The membership of the American Institute of Electrical Engineers is widely spread over the country. It would be well for each individual in that membership to consider his position as an engineer in relation to his neighbors who are not engineers. Is he doing his best to interpret engineering in human terms? Is he taking sufficient, or any, interest in civic problems? Is he making any effort to show that his engineering training and experience have taught him any more than how to work a slide rule or solve a differential equation? There are comparatively few members of the rank and file of the Institute who are qualified to address a local civic meeting. This is not because there is nothing for them to say—there is plenty for them to say—but because they think they cannot present their engineering information in any other form than as a collection of cold facts. The reason they think they cannot speak to popular understanding in warm human terms is mostly because they have seldom tried to do it.

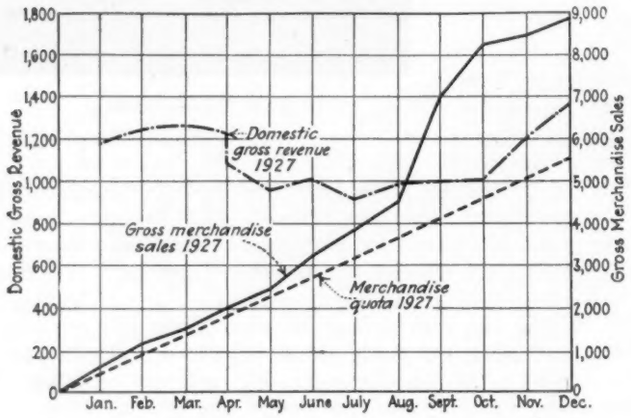
"If we engineers would see ourselves accepted as the benefactors of mankind that we think ourselves to be, we must attune our thoughts and our manners of expression to the thoughts and manners of our fellows."

Merchandising Makes Rate Reduction Profitable

By Edwin W. Vennard
General Commercial Manager Southwestern Gas & Electric Company, Shreveport, La.

A MOST interesting example of what can be accomplished in building up domestic consumption and revenue by merchandising activities in conjunction with reduction and readjustment of the residential rate is manifest in the case of Henderson, Tex., a town of about 3,000 population, served by the Southwestern Gas & Electric Company.

When this property was taken over public relations


Domestic Gross Revenue
Gross Merchandise Sales
Domestic gross revenue 1927
Gross merchandise sales 1927
Merchandise quota 1927
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

How initial effect of rate reduction was offset by merchandise activity

were not of the best, largely because of the nature of the rate for domestic service which was in effect. The domestic rate was as follows:

	Kilowatt-Hour per Month	Net per Kilowatt-Hour, Cents
First	10	20
Next	90	10
Next	100	8
Next	300	7
Excess		6

Minimum charge, $1.50 per month, no discount.

This rate averaged the domestic consumer in Henderson approximately 18 cents per kilowatt-hour, which was too high to encourage the use of any of the time or labor-saving electrical devices. With these conditions existing it was decided that something must be done in the way of readjusting the rate and selling electrical appliances. The results afford an excellent example of what can be accomplished by a material rate reduction followed up by a merchandise campaign, the following room count rate having been decided upon and made effective April 1, 1927:

	Kilowatt-Hour per Room per Month	Net per Kilowatt-Hour, Cents
First	4	12
Next	4	9
Excess		6

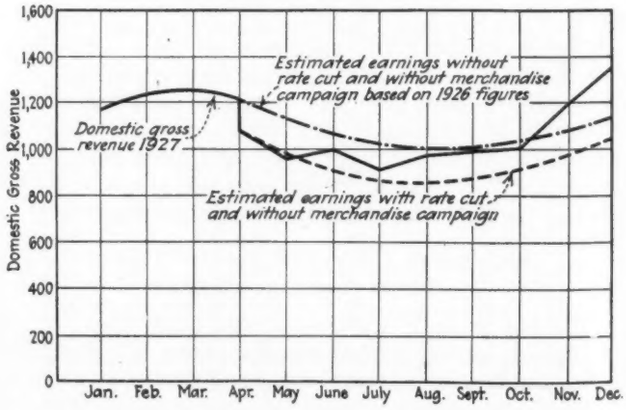
Minimum charge, $1 per month, no discount.

The new rate averaged less than 12 cents per kilowatt-hour and amounted to a considerable reduction in the gross revenue from that town. Definite action was again taken with directed selling efforts in an endeavor to build up the revenue. Letters were sent to each customer explaining the new rate, emphasizing the voluntary reduction and stressing the fact that the reduction was made so that customers could make more use of electric service and so that electric labor and time-saving devices could be used economically in the home. These letters were backed up with newspaper advertising explaining that customers could use more electricity for the same cost as theretofore.

Then followed in Henderson a crew of electrical merchandise salesmen, and the increase in sales can be seen in the accompanying curves. The merchandise sales bogey set for Henderson for the year was $10 per meter. It will be noted that up until the time the rate was cut Henderson was a trifle in excess of this bogey. Beginning in May, and becoming more apparent in August, a large increase in merchandise sales will be noted, totaling approximately $9,000 by the end of the year. It is interesting to note the manner in which the domestic gross revenue increased directly with the increase in merchandise sales.

A second curve shows the manner in which the gross revenue in Henderson increased as compared to the estimated earnings without the rate cut and without the merchandise campaign as compared to the estimated earnings with the rate cut and without the merchandise campaign. It will be seen that there was a material reduction in the revenue following the rate cut, but that because of the merchandise activities this revenue gradually increased until by the end of December it was considerably higher at the new rate than it would have been at the old rate of 18 cents per kilowatt-hour. The revenue at this time from Henderson was $230 per month higher than it would have been at the old rate, showing that eight months following a rate reduction the revenue per month had increased by more than 20 per cent.

This rate reduction proved conclusively to the company that the high rates frequently in effect in the small communities can be reduced materially and greatly to the advantage of the power company. Following this


Domestic Gross Revenue
Estimated earnings without rate cut and without merchandise campaign based on 1926 figures
Domestic gross revenue 1927
Estimated earnings with rate cut and without merchandise campaign
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Rate reduction plus merchandising increased earnings

experiment, it has been the policy of the company to put into effect promotional rates, this being done gradually so as not to affect materially the company's revenue. Because of this rate reduction in Henderson there was effected an even more desirable condition than increase in gross revenue, and that is vastly improved public relations. Customers are better satisfied, have greater confidence in the company and the public began to realize that it was dealing with a company that was endeavoring to be of real service to it.

The Electric Water Heater—
A Major Load Builder*

Governing factors which should be considered in the profitable development of a domestic water-heating load

By W. F. CLARK
Sales Manager Automatic Electric Heater Company, Philadelphia, Pa

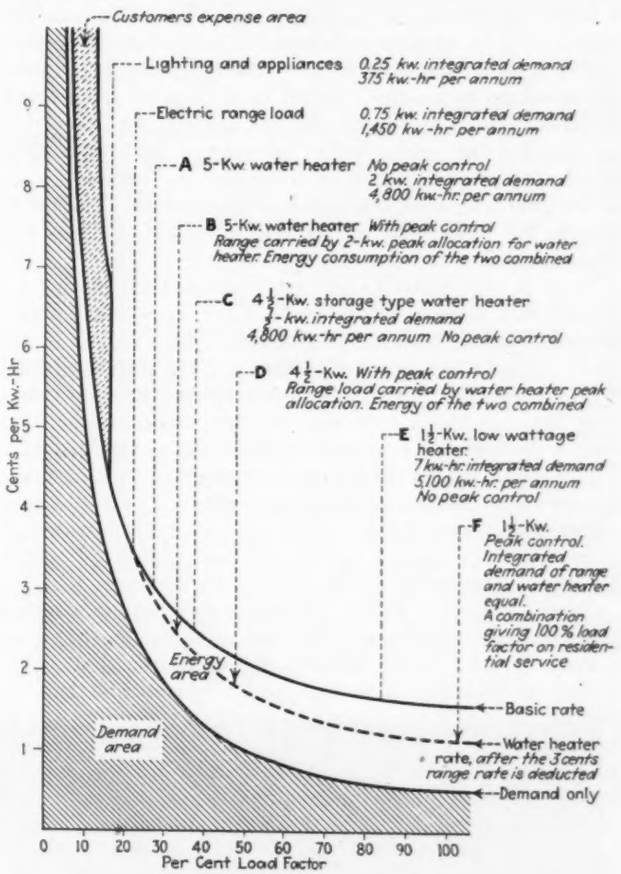
PRESENTED here is the result of a most careful investigation of existing water-heater installations in various parts of the United States and Canada. I have shown graphically in the accompanying chart the direct effect of load factor on rate, something that no "hop, skip and jump" type of inducement rate will do, and it is my hope that some of the hazy notions with regard to water-heating business can be cleared up.

Integrated peak and energy consumption values have been obtained from the N.E.L.A. domestic cooking and water heating committee report, and that committee, I think, has done sufficient work and research to justify the adoption of the values set forth. However, each utility may readily make up its own data by simply taking, for instance, ten daily demand charts from ten consumers and superimposing all of them and plotting an integrated demand chart which will give the diversity created by their particular consumers.

The point brought out in this chart is that a company which has a 6½-cent rate for lighting and a 3-cent rate for cooking is already justifying a 1½-cent rate for low-wattage water heaters, even though it does not know it, and the executives may throw up their hands in holy horror should any one suggest a 1½-cent or 2-cent rate.

In the chart an assumed basic rate structure has been plotted. This structure is that of a utility in which the average investment per kilowatt is $300, upon which can be earned 15 per cent per annum to cover all interest, taxes, maintenance, depreciation, etc. The demand element then becomes $45 per kilowatt per annum. The lower curve shows the demand allocated to each energy unit throughout the load factor range. Particular attention is directed to the large proportion of the total cost of service which this demand element represents at the lower load factors which are representative of today's residential business. The energy cost element of the rate has been taken at 1 cent per kilowatt-hour, and this value has been superimposed on the demand element curve, giving the basic rate curve shown on the chart. The customer's cost element has been assumed at about $8 per customer per annum, and this value has been superimposed in that load factor range represented by the normal demand of the customer for lighting and appliance service, or what is usually the first block in an inducement rate.

Various forms of utilization energy consumption have been indicated on this chart by vertical lines intersecting the basic rate curve at their proper load factors, the point of intersection thus giving the proper rate at which such business can be taken on the system and earn a uniform profit for each class of utilization. The first intersecting line shows the average consumption and integrated system demand per customer for lighting and appliances, the use being that obtained by the N.E.L.A. committee. The second line is that for electric range operation, using average use as obtained by the same committee. This line serves to indicate that the 3-cent rate, with which it has been demonstrated electric cooking can readily compete with cooking with fuel, this being within the


Customers expense area
Lighting and appliances 0.25 kw. integrated demand 375 kw.-hr per annum
Electric range load 0.75 kw. integrated demand 1,450 kw.-hr per annum
A 5-Kw. water heater No peak control 2 kw. integrated demand 4,800 kw.-hr. per annum
B 5-Kw. water heater With peak control Range carried by 2-kw. peak allocation for water heater. Energy consumption of the two combined
C 4½-Kw. storage type water heater ½-kw. integrated demand 4,800 kw.-hr per annum No peak control
D 4½-Kw. With peak control Range load carried by water heater peak allocation. Energy of the two combined
E 1½-Kw. low wattage heater 7 kw.-hr integrated demand 5,100 kw.-hr. per annum No peak control
F 1½-Kw. Peak control. Integrated demand of range and water heater equal. A combination giving 100% load factor on residential service
Energy area
Demand area
Basic rate
Water heater rate, after the 3 cents range rate is deducted
Demand only
Cents per Kw.-Hr
0 10 20 30 40 50 60 70 80 90 100
Per Cent Load Factor

Basic rate structure showing effect of load factor upon rate earned

*Abstract of a paper presented at the East Central Geographic Division, N.E.L.A., convention at Cedar Point, Ohio, July 10-13, 1928.

"value of service," is also close to the "cost-of-service" point, and therefore such business is earning its fair share of the essential profit on all business.

Following these lines a series of others have been plotted showing various types of water heaters and the rates which must be obtained from their operation in order that they may carry their share of the profit-earning burden.

Characteristics of Different Types

Line *A* is that of a typical 5-kw. water heater which has become popular in some localities owing to its quicker recuperating values where a storage tank of limited capacity is used. Unquestionably, this type of heater is giving satisfactory service to the consumer from the operating standpoint, and for that reason is being advocated by some commercial departments that have not given fair consideration to "cost-of-service" element. It must be understood that without load-factor control such a heater must assume the 3-cent range rate if loss to the utility is to be avoided. Where the range rate is applied the customer endeavors to keep his operating cost down by resorting to manual control or a class of service not equal to that of the automatic gas heater. In doing this he can get his consumption of energy to around 300 kw.-hr. per month, but in so doing he cuts the load factor to 20 per cent, which requires a 3½-cent rate. In other words, he forces the utility into a loss of ½ cent per kilowatt-hour.

Line *B* shows the same heater in combination with a double-throw switch, or load factor regulator, which prevents use of both range and water heater at the same time. Since the integrated demand of the combined load will not exceed that of the water heater, it is apparent that the combined rate will be the value at point of intersection of the two lines. When the energy used by the range at the 3-cent rate is deducted the proper water heater rate becomes 2½ cents, as indicated by the dotted water-heater rate curve. This rate is materially better than the range rate, but still not low enough to permit the easy introduction of the electric water heater.

Line *C* shows a 4½-kw. storage water heater operated without peak regulation. This heater is designed to give service equal to that of the 5-kw. heater, but overcomes its features as to high peak demand and lack of proper auxiliary equipment to avoid extraordinary heat losses. The integrated demand due to a three-section progressively controlled heating element will not exceed 1½ kw., while the consumption will be the same as in the former heater. It will be noted that this size of water heater justifies a 2½-cent rate, or, in other words, it will do as much for the utility without peak control as the other heater will do with peak control.

Line *D* shows the 4½-kw. water heater provided with peak control, so that both it and the range can be used at the same time and thus have their respective peaks superimposed. Here we find that a water-heater rate of 1¾ cents can be granted and still provide the same profit margin as that of a 5-kw. heater, for which a high rate must be charged if a loss is to be avoided. At this 1¾-cent rate it will be possible to compete readily with any gas heater that is capable of rendering comparable water-heating service. For load factors better than is possible with these high-demand heaters a wide range of selection is available, since the rate curve has flattened out and another range of rates is within both "value of service" and "cost of service."

As the "cream" is at the higher load factors, every effort should be made to secure maximum results in this respect when any policy as to water-heater specifications and control of usage is adopted. In order to insure satisfaction to the consumer and meet these requirements a low wattage 40-gal., 1,500-watt heater has many advantages. One such heater has a two-section element progressively and automatically controlled and will integrate on the system at approximately 0.7 kilowatt maximum demand. Because of the high thermal storage capacity the radiation losses are slightly more than for small storage type heaters. This factor has been taken care of in the plotting of the curve. It will be noted that this heater, shown as line *E*, gives the rate curve just slightly above the 1½-cent mark. At the 1½-cent rate it can be readily introduced in competition with any other form of water heating. Its load factor of approximately 80 per cent is far better than that of any but the most exceptional industrial power applications. It is suggested that such a heater be connected with a load factor regulator or peak control. Its integrated peak demand is approximately the same as that of a range and therefore the two units when interlocked can be closed as one piece of utilization equipment.

Line *F* shows what happens when this plan is adopted. The utility has a load with approximately 100 per cent load factor and an integrated demand that does not require expensive local investment to serve. It will be noted that with this heater and peak control a rate but slightly more than 1 cent will return a fair profit. However, since a rate of 1½ cents is amply low enough to keep well under the "value of service" limitations, there is no necessity of passing on this "cost-of-service" value to the consumer. This margin can well be applied to an intensive sales campaign to approach the saturation point on electric water heaters together with a liberal servicing policy.

The Need for Hot Water Service

It has been suggested that electric water heating must for some unknown reason follow the electric range, but experience will prove that electric water heating service can be sold to any number of homes that are not yet using electricity for cooking.

The greatest opportunity offered the utility today in the matter of increasing residential consumption would be accomplished without additional line investment by promotion of the use of low-wattage heaters on existing two-wire, 110-volt service. There is a tremendous rural population now using any available means for heating hot water. Therefore, I believe it possible to merchandise a large number of low-wattage water heaters to those homes that are not yet equipped with range service and believe that the satisfaction received from the electric water heating service will make the prospect considerably more susceptible to the use of electricity for cooking.

To sum up the results of what can be done with a residential customer having the average lighting and appliance consumption and demand, using an electric range and 1,500-watt dual circuit peak control water heater, the combined integrated system demand will be approximately 1 kw. and the annual consumption 5,500 kw.-hr. This means a load factor of 62½ per cent, which takes an average rate of 1¾ cents and gives an annual return per residential customer of very close to $100 with the rate lowered down to the "cost-of-service" limit. This would be around $112 per annum with a tertiary or water heater rate of 1½ cents or the fair "value of service." As previously stated, these estimates are based entirely

upon an arbitrary and selected "cost-of-service" curve. The method used, however, can be duplicated by any utility statistical department plotting its own cost curves from the available data.

In selecting any inducement rate to encourage free use of electric water heaters it must be borne in mind that the investment per kilowatt of integrated peak will gradually reduce with increased system capacity that follows any intensive development of low-demand high-load-factor utilization equipment. This is largely because a greatly increased system load can be served with a very moderate increase in the distribution system investment. The same argument applies, to somewhat less extent, to the investment required for substations, transmission systems and major generating stations. Taking this inherent characteristic of utility systems into consideration, it follows that any rate based on "cost of service" will naturally trend toward increased earnings. However, a rate should never have been granted to meet "value of service" which would be below the "cost-of-service" line as it now exists. Suitable governing restrictions as to the type and method of control of utilization equipment will automatically adjust any discrepancy between "cost of service" and "value of service."

There is no service in the home that is more essential than a reliable and convenient supply of hot water, and the development of the domestic electric water heater load deserves the most serious considerations by every utility executive.

And Now—Golf by Artificial Light

A GOLF contest under artificial illumination was staged at the annual field day of the Philadelphia section of the N.E.L.A. recently. According to Arthur A. Brainerd, illuminating engineer of the Philadelphia Electric Company, "No balls were lost in the contest. One player made the hole in one stroke under par and some of the players expressed themselves as being able to play better by artificial lighting than by daylight."

The fairway was lighted with eighteen 1,500-watt floodlighting projectors mounted on short posts about 4 ft. above the ground. Sixteen of these lights illuminated the ground itself and two 24-in. projectors were used to pick up the ball in the air. The tee and putting green were each lighted with one 1,500-watt B.B.T. floodlighting unit with a 180 deg. Fresnel lens.

Electric Melting Saves Connecticut Brass Mills Over Million Yearly

BY CONSERVATIVE estimate, electric brass melting is saving the mills of Connecticut more than $1,000,000 annually, according to a paper presented at the American Elcetrochemical Society's recent Bridgeport convention by Robert M. Keeney, industrial heating engineer Connecticut Light & Power Company. Connecticut industrial plants have been very progressive in the use of electric heating, largely on account of the over-all cost savings realized. The industries of the state have about 35,000 kw. of electric heating equipment, consuming more than 100,000,000 kw.-hr. per year. Of this furnace capacity, 22,000 kw. is installed for the melting and annealing of non-ferrous metals. For annealing non-ferrous metals Connecticut has 27 furnaces and annealing machines of 5,865 kw. installed capacity, distributed among fifteen plants. The units included are shown in the accompanying table.

NON-FERROUS METAL ELECTRIC ANNEALING FURNACES IN CONNECTICUT
January, 1928

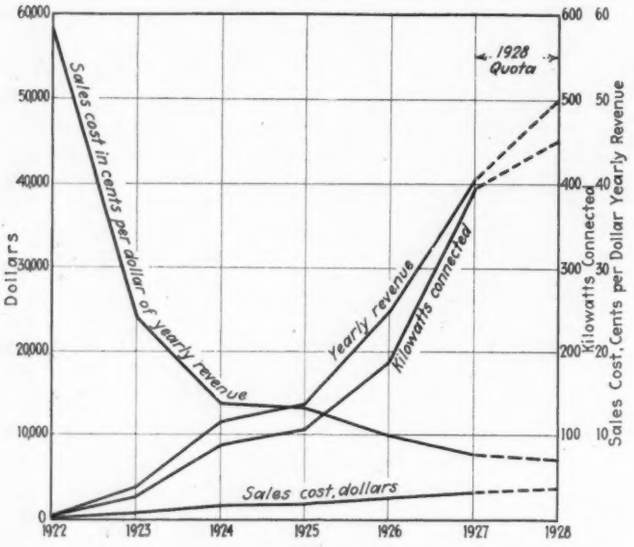
Plant No.	Application	No. of Furnaces	Kilowatts, Each	Total Kilowatts
1	Brass and aluminum tubing	3	350	1,050
	Copper tubing	4	120	480
2	Copper tubing	1	390	390
3	Brass shells	2	150	300
4	Brass shells	2	150	300
5	Condenser tubing (annealing machines)	1	500	500
6	Nickel-silver stampings	1	60	60
7	Nickel-silver stampings	2	80	160
8	Nickel-silver stampings	1	100	100
9	Nickel-silver stampings	2	100	200
10	Nickel-silver stampings	1	45	45
11	Brass shells	1	300	300
12	Brass eyelets	1	80	80
13	Miscellaneous, shells and sheet	1	150	150
	Miscellaneous, shells and sheet	1	250	250
	Condenser tubing (annealing machine)	1	500	500
14	Condenser tubing (annealing machine)	1	500	500
15	Condenser tubing (annealing machine)	1	500	500
	Total	27		5,865

Putting green floodlighted for golf at night

Hundredfold Increase in Sign Revenue

GROWTH of the electric sign load on the lines of the Rockford (Ill.) Electric Company from 1922 to 1927 serves as an excellent example of what a central-station company can do to promote this business by well-directed sales effort. From the accompanying table and chart it will be seen that during the five-year period the yearly revenue from the electrical advertising load taken on each year has increased from $450 in 1922 to $40,590 in 1927 and the quota set for 1928 is $50,000, more than one hundred times what it was six years ago.

D. L. Cash, commercial manager of the Rockford Electric Company, in reviewing the company's practice in developing the sign load, stresses the necessity for the power company to have in its sales department a trained sign specialist. Such a man in an average community would return to the power company additional revenue of around $50,000 per year based on 100,000



Results from directed effort to sell electrical advertising
Note how unit sales costs have dropped as volume increased.

population. Of course, Mr. Cash points out, a close working arrangement must exist between the power company and the sign manufacturers and the power company specialist must be carefully selected, well trained, closely supervised and operate preferably on a yearly quota basis. Hit-and-miss campaigns, calls on only select prospects occasionally, or direct mail advertising will not of themselves sell signs. The primary requisite is trained man-power. All other promotional factors must operate to back up this trained man-power and these other factors remain secondary as supporting elements.

It is significant to analyze briefly the results of putting the foregoing sales policy into effect. Up to the fall of 1925 electrical advertising was sold by all members of the sales department. Then a full-time specialist was put on and the yearly revenue from additional sign load in the years 1926 and 1927 are virtually double and treble that of 1925. Another important result has been the reduction in sales cost per dollar of revenue. In 1922 this amounted to 58.8 cents per dollar of yearly gross income, while for 1927 it had dropped to 7.5 cents per dollar of yearly revenue, and under the quota for 1928 is expected to drop still somewhat lower.

ELECTRICAL ADVERTISING SALES AND COSTS FOR PAST SIX YEARS

Year	Kw. Connected	Yearly Revenue	Sales Costs Total	Sales Costs Per Dollar Yearly Revenue (Cents)
1922	5	$450	$265	58.8
1923	26	3,808	900	23.6
1924	87	11,561	1,600	13.8
1925	105	13,762	1,850	13.4
1926	187.5	24,701	2,450	9.9
1927	394	40,590	3,040	7.5
1928 (quota)	450	50,000	3,600	7.2

Letters from Our Readers

Calculating Short-Circuit Currents

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of June 23, 1928, on page 1351, you have a letter by L. S. Foltz describing a method of getting short-circuit currents in a network, considering both resistance and reactance. There is a fundamental error in the first part of the mathematical derivation.

$$(1)\quad I_r = \frac{E}{R},\ I_x = \frac{E}{X}$$

$$(2)\quad I_{sc} = \frac{E}{Z} = \frac{ER}{R^2 + X^2} - j\,\frac{EX}{R^2 + X^2}$$

The R and X used in (2) are not equal to the R and X of (1) unless only a series circuit is considered.

The true value of R and X of the second equation may be worked out, but the resultant equations are quite cumbersome. To show the error in the method consider a simple parallel circuit, one circuit having 2-ohm reactance and 1-ohm resistance, the other 1-ohm reactance and 2-ohm resistance. Then

$$I_{sc} = \frac{E}{\dfrac{(1+j^2)\ (2+j^1)}{3+j^3}} = \frac{E\ (3+j3)}{j5}$$

$$I_{sc} = 3/5 - j\ 3/5 = .85\ E$$

If this circuit were set up as suggested on the calculating table the results obtained would be

$$I_r = \frac{E}{R} = \frac{E}{\dfrac{2\times 1}{2+1}} = 3/2\ E$$

$$I_x = \frac{E}{X} = \frac{E}{\dfrac{2\times 1}{2+1}} = 3/2\ E$$

Using the formula for combining I_r and I_x

$$I_{sc} = \left[\frac{\dfrac{1}{I_r}}{\dfrac{1}{I_r^2} + \dfrac{1}{I_x^2}}\right]^2 + \left[\frac{\dfrac{1}{I_x}}{\dfrac{1}{I_r^2} + \dfrac{1}{I_x^2}}\right]^2$$

$$= \frac{I_r I_x}{\sqrt{I_r^2 + I_x^2}}$$

$$= \frac{3/2 \times 3/2E^2}{\sqrt{(3/2E)^2 + (3/2E)^2}} = 1.06E$$

If the network were only a series circuit with different constants along the line, such as overhead lines and cables in series, the correct result could be obtained by merely dividing the voltage by the total of the resistance plus reactance.

R. C. BUELL,
Central-Station Engineering Department.
General Electric Company,
Schenectady, N. Y.

[L. S. Foltz advises that the formula he presented applies to series circuits only, and that he will supplement this with a new derivation which will have a wider application.—EDITOR.]

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Steam Boiler Water Treatment.—A. T. RIDOUT.—A non-chemical method of preventing the accumulation of scale in water-circulating systems by the employment of true colloids which it is claimed will even enable sea water to be used for make-up purposes is described. The colloidal solution involved in the present consideration is purely physical in its action. It is not necessary to have a complete mineral analysis of the water except for the purpose of estimating the total amount of solids which will have to be dealt with. In the experiments by the author linseed has been used as the colloid source from which the starch utilized for this purpose is obtained. In the system in question a cast-steel receptacle having inside it a perforated canister contains the linseed and steam is introduced into the apparatus and infusion of the linseed obtained, the infusion having the colloidal properties necessary for the efficient treatment of feed water. The amount of linseed required is very small, being approximately 1 lb. of seed to every 2,000 gal. of water, a concentration of approximately one in 60,000. Aside from the positive results which are obtainable by this system, the other advantages are the lower cost of upkeep installation and also the difference in the space occupied by the equipment as compared with that necessitated in chemical installations. In practice both acid attack on the boiler and galvanic action are said to have been arrested.—*Electrical Review (England)*, June 1, 1928.

Progress in Hydro-Electric Installations.—JAMES MCLELLAN.—A review of the progress in hydro-electric installations, including intakes, tunnels, dams, headraces, pipe lines and tailraces, with particular consideration for recent developments in this branch of power-plant engineering, has been offered by the author. Among the features considered are large developments, high head installations, potentialities for more complete utilization of available sources, ice problems and the relative desirability of certain types of dams, including hollow, multiple arch and hydraulic and semi-hydraulic structures.—*Engineering (England)*, June 22, 1928.

Transmission, Substations and Distribution

Substation Arquata Serivia.—L. VELLARD.—About half way between Genoa and the River Po the main Italian 130-kv. lines join with the 60-kv. lines of the Italian Edison Company. A tie-in substation has been erected at this point, to allow an interchange of power between these two systems and to supply at the same time 4,000-volt, 16⅔-cycle, single-phase current to a nearby electric railway. To regulate the flow of reactive energy the station has also been equipped with synchronous condensers. Three water-cooled, three-phase transformers of 14,500 kva. each tie the two main systems, while a tertiary winding in each supplies the three 6,000-kva. rotary condensers. Three motor-generators, comprising per group an induction motor coupled to an 8,600-kva., single-phase generator, furnish the railroad supply.—*Revue Générale de l'Electricité*, May 26, 1928.

Operating Experiences with High-Speed Oil Circuit Breakers.—B. F. BARDO.—The experiences of an Eastern railway with three high-speed oil circuit breakers installed several years ago on electrified branch lines handling both freight and passenger traffic are outlined in this article. The satisfactory operation of paralleling commercial communication circuits presented an immediate problem which investigation disclosed required high-speed circuit breakers. The electrical and mechanical characteristics of these are enumerated. This equipment was subjected to a number of tests made by short-circuiting the 11,000-volt lines under currents up to 3,000 amp. and opening in from one-half to one and one-half cycles with satisfactory operation of commercial and railroad communication facilities. Service records have been included.—*Journal of the American Institute of Electrical Engineers*, July, 1928.

Motors and Control

Electric Drive in the Iron and Steel Industry.—Motor application in steel mill practice are considered in a number of articles in this issue of the *General Electric Review*. The blooming, roughing and finishing mills with their driving motors and the flywheel motor-generator sets used at the Lackawanna plant of the Bethlehem Steel Company have been covered, as have the operational and design characteristics of the new 84-in. tandem plate mill of the Lukens Steel Company. Service records of auxiliary motors in steel mill practice, the application of synchronous motor-generator sets to steel mill reversing drives, some recent developments in motor control and a device for coiling cold-rolled strip steel as it passed from the cold-strip mill stand of an alloy steel mill are also described.—*General Electric Review*, June, 1928.

Water Rheostat.—M. O. BLANDIN.—For starting large induction motors water resistors are, as a rule, smaller and less expensive than metallic resistances. An unusually compact three-phase type of such a starter is described in this paper. Both the moving and the stationary electrodes are made as concentric bronze rings, which fit into each other toward the end of the stroke, reducing the end resistance to a minimum. The range of resistance between start and finish is thus exceptionally large. The small weight of moving electrodes simplifies the operating mechanism. The vigorous thermo-syphon circulation of the electrolyte prevents the formation of boiler scale, commonly encountered with other types of water box starters. The rheostat is rated 1,600 amp. at 3,500 volts and can be applied to motors of up to 4,500 kw.—*Brown, Boveri Mitteilungen*, June, 1928.

Electrophysics, Electrochemistry and Batteries

Effects of Arcs on Insulators.—K. DRAEGER.—During the recent years of development of high-voltage insulators the greatest attention has been paid to securing a maximum of dielectric strength. Having solved this problem to a satisfactory degree, present attempts are directed toward making insulators and chains of insulators more reliable against mechanical and thermal or arc influences. If an arc-over destroys a chain, its initial high electric strength becomes of secondary importance. Designs and arrangements are described which tend to lessen the danger of a flash-over across pin type, rod type and chain type insulators. On seven rod type insulators 23 flash-over tests were made with up to 22,000-kva. short-circuit energy and 17,500 volts. The obtained data are given in a tabulation. The shape of the metallic cap appears to be a deciding influence upon the effect of the arc. The customary large bead on the bottom of the cap was found detrimental in every case. The most promising method to study the arc-over of insulators is high-speed motion pictures, released at normal speed to give on the screen greatly retarded action.—*Elektrotechnische Zeitschrift*, May 24, 1928.

Consumers' Storage Batteries.—E. DÄHNE.—Current demand during the peak-load period commands the highest rate and taxes the installed capacity of the central station. The author advocates in this article the installation of storage batteries at the consumer's premises to be charged during off-periods at the lowest obtainable rate, the customer to derive the peak load from the charged battery instead of from the supply line. It is claimed that such a system furnishes the load more cheaply to the customer and helps the central station by reducing the peak demand and creating a desirable night load. The article goes into great detail to show the economies of such a system for various loads and various durations of the load. Cost figures are tabulated and shown graphically that tend to bear out fully the considerable savings pos-

sible. Even for alternating-current supply, where a conversion into direct-current is necessary, sizable profits can be made. The author has in mind particularly the load required by large electric advertising signs. — *Elektrotechnische Zeitschrift,* May 24, 1928.

Units, Measurements and Instruments

A High-Speed Graphic Voltmeter for Recording Magnitude and Duration of System Disturbances.—A. F. HAMDI and H. D. BRALEY.—The high-speed recording voltmeter described by the authors is one of a number of types designed to supply a type of instrument which would make an accurate record of system disturbances. A description of the electrical and mechanical details of the instrument, with particular reference to the requirements which were submitted to the manufacturers who developed the device, precedes an interpretation of the records obtained and of their value to the engineering and operating departments of the utility specifying the equipment. Among the characteristics demanded were: A graphic voltmeter responsive to all voltage fluctuations, but well damped so as to be free from over or under-shooting even for 100 per cent voltage standards; minimized energizing of time at rated voltage; high-speed timing accuracy; satisfactory chart acceleration, and sensitive setting of low-voltage relay. It is indicated by the authors that the requirements for this service have been fully met in practical operation.—*Journal of the American Institute of Electrical Engineers,* July, 1928.

Electric Welding. — A symposium. This special issue is devoted entirely to subjects on electric arc and resistance welding and comprises a number of papers which were presented before a recent meeting of German and Austrian welding societies. A great deal of highly specialized and up-to-date information is available, covering the subject matter from all angles. Noteworthy data are given, for example, in an oscillographic study of the welding process, on latest experiences with X-ray testing of welds, on the general economies of electric welding, on automatic and semi-automatic arc welding, on the savings in time, cost and weight realized in the building of a 200-ton oil tanker and on the welding possibilities of non-ferrous metals and alloys.—*Elektrotechnik und Maschinenbau,* May 27, 1928.

Heat Applications and Material Handling

Maximum Allowable Unit Working Stresses for Fusion-Welded Joints.—Formulas and tabulated strength factors for welded joints are offered in this article. The material has been published largely with the view of securing public comments and criticisms of the proposed standards of the A.S.M.E. boiler code committee. — *Mechanical Engineering,* July, 1928.

Traction

Effect of Street Railway Mercury-Arc Rectifiers on Communication Circuits.—CHARLES J. DALY.—The effects produced on telephone circuits in the neighborhood of the two mercury-arc rectifier substations recently installed in an Eastern city are described by the author. The relative magnitude of the interference effects between rotating equipment and mercury-arc rectifiers when used for street railway supply service are presented in conjunction with an exposition of the method and type of apparatus used to reduce the effects experienced from the equipment in question.—*Journal of the American Institute of Electrical Engineers,* July, 1928.

Railway Electrification Economics.—H. F. TREWMAN.—The economic factors involved in the electrification of the Paulista Railway in Brazil have been considered, with particular reference to the ultimate economy realized in the installation. Tabulations of costs are offered for combined steam and electric operation, as well as for all steam and electric conditions. The author has endeavored to point out the importance of local conditions in any such electrification scheme and states that the two prime considerations are fuel or power cost and traffic density in ton-miles per annum per mile of track.—*Electrician (England),* May 25, 1928.

Telegraphy, Telephony, Radio and Signals

The Distribution of Current in a Transmitting Antenna.—RAYMOND M. WILMOTTE. — An investigation was undertaken for the purpose of determining the validity of the assumption made regarding the distribution of current in an antenna and to ascertain if sufficiently close approximation to conditions obtaining in practice were realized. The current distribution of a straight, vertical antenna was found experimentally by placing ammeters at various points along the antenna and reading them by means of a telescope. In order that the effect of the ammeters might be calculated the antenna was constructed in the form of a cage with the ammeters inside. The capacity effects were thus eliminated. The self-inductance of the ammeters was measured and a correction for it was applied to the theoretical curves. A number of conclusions were derived and illustrated in the curves prepared as a result of this investigation. —*Journal of the Institution of Electrical Engineers (England),* June, 1928.

Aircraft Radio and Navigation.—ROSS GUNN.—The essential engineering features of aircraft radio and associated difficulties are discussed. Solutions to these problems are given, although no attempt has been made to describe particular equipment. Two outstanding radio aids are discussed and a new method described whereby these can be made to operate a visual indicator in such a way that it will not only tell the pilot whether he is off his course but which way he is off. A heterodyne beacon having certain remarkable directional properties is also discussed.—*Journal of the Franklin Institute,* June 1, 1928.

Miscellaneous

The General Theories of Strain and Elasticity.—CHIDO SUNATANI.—The author has considered the strain problems in a general deformation and has applied some unusual methods and observations. It is demonstrated that in almost all strain problems the subject may be simply treated and expressed by the use of vector quantities which represent in amount and direction a material straight line, the normal between a pair of parallel material planes and the relative displacement of a particle. Among the results obtained by this method are the indication that the strain of a material plane and its tangential component become the maximum in a general case for pairs of material planes, the normals of which are perpendicular to the axis of the middle principal strain and have inclinations to the axis of the greatest principal strain as indicated in a derived mathematical expression. In addition to the analytical treatment these problems are illustrated graphically by means of strain ellipsoid and reciprocal strain ellipsoid in a general case and by a plane diagram in a case of small strain. It is concluded that from a mathematical standpoint Hooke's law cannot be strictly true; that is to say, stress and strain cannot be strictly proportional, and that the law has to be modified to be such that the principal strains are in linear relations to the forces on the principal planes which have unit areas in the unstrained state.—*Technology Report of the Tohoku Imperial University (Japan.)*

Cost of Current from Wind Turbines. —K. BILAU.—For the direct drive of plunger pumps, the customary slow speed wind wheel was found satisfactory for generations. Attempts to drive an electric generator from these wheels in order to supply light and power to small farms, however, had to be abandoned for various reasons. The slow speed had to be geared up through uneconomical trains of gears, and from the nature of the wheel, requiring as it did a considerable wind velocity to start, operation called for a large storage battery to tide over periods of calm or insufficient wind. Since the new four-vane high-speed propeller type of wind turbine has become known a new and much more promising impetus was given to the wind-electric plant. Starting safely with as low as 3 miles per hour wind, the propeller wheel can utilize as much as 92 per cent of the prevailing winds, as against 17 per cent with the old wheel. Tests made in England with such modern plants indicated an average cost of 1.2 cents per kilowatt-hour, including a very small storage battery.—*Elektrotechnische Zeitschrift,* May 31, 1928.

News of the Industry

Regulation of Municipals Argued in Court

Indiana Supreme Bench Hears Pleas Involving Basic Principles of Utility Regulation—Attorney-General Denies Difference in Utilities

ORAL arguments, in which the constitutional right of the Indiana Public Service Commission was questioned in regulating the rates of a municipally owned utility, were heard recently by the Indiana Supreme Court in a case in which the city of Logansport appealed from a rate schedule on electric current fixed by the commission. Attorneys representing the city argued that the commission has no right to fix rates and that the state Legislature deprived the city of its inherent right of local self-government when the public service statute was drawn.

The case in question was one in which Frank T. Singleton, chairman of the commission, in September, 1926, fixed only sufficient rates to permit the operation of the plant and maintain a reasonable depreciation reserve. This also was attacked by appeal attorneys, who declared that the commission, if it has authority, should have fixed rates sufficiently high to permit a return of 7 per cent on an investment of slightly over $1,000,000 and enough more to bring in a sum equal to the taxes on a similar investment the same as a privately owned utility.

Attorney-General Arthur L. Gilliom, representing the commission, declared that no question of local self-government is involved and that the question of the right of the Legislature to grant regulatory authority to the Public Service Commission over municipally owned as well as privately owned utilities has been upheld in several instances by the Supreme Court. He declared there is no distinction in the law between the two kinds of utilities.

St. Lawrence Development to Be All-Canadian

The terms of the agreement under which the Beauharnois Light, Heat & Power Company is permitted to divert 40,000 cu.ft. of water per second between Lake St. Francis and Lake St. Louis, on the St. Lawrence, have been made public. The power developed will be absorbed by large industrial concerns in the immediate vicinity of the city of Montreal. The contract has been favorably acted upon by the Canadian Government. As reported in the ELECTRICAL WORLD for March 10, 1928, page 523, this action was to be anticipated as a result of the approval of the bill by the private bills committee of the Quebec Legislature.

The terms of the agreement call for yearly rental to be paid by the company to the government of $20,000 for the first five years and $50,000 a year for the remaining period. The company has agreed, furthermore, to develop 100,000 hp. during the first five, 200,000 after the sixth, 300,000 after the seventh and 500,000 by the end of the tenth year. The company will spend in the neighborhood of $30,000,000 in the development of the project.

One of the provisions of the order-in-council is that the company will not export any of the power it develops to the United States, either directly or indirectly. If a sufficient market is not found for the power produced the company is authorized to dispose of a certain amount of the surplus to the Ontario Hydro-Electric Commission or any similar responsible company, providing "that the amount thus exported does not exceed 50 per cent of the total produced, and before any power can be exported or otherwise disposed of permission to sell must be obtained from the Lieutenant-Governor in Council."

The government further reserves the right to cancel and annul the entire contract should any of the power thus exported be sold to the United States, while the prices charged for power in Quebec must not be higher than those fixed for that sold in Ontario as provided for by the order-in-council.

Neon Light Patent Is Held Valid and Infringed

The patent granted Jan. 19, 1915, for a system of illuminating by luminescent tubes employing neon is reported to have been held valid and infringed by the Circuit Court of Appeals for the Second District.

This decision involves the case of Claude Neon Lights, Inc., vs. E. Machlett & Son, the former being the assignee of the patent in suit. A second patent was held invalid on the ground that it was anticipated by the disclosure of the patent held valid.

The invention, the opinion states, does not reside in the physical properties of the neon gas, the discovery of which was old, but in the appreciation of the advantages of these properties and in the selection and adaptation of a gas to practical and commercial systems of illumination in which certain difficulties were overcome.

The decree of the District Court was modified, the lower court having held the patent in question valid but not infringed.

Obsolete Equipment to Be Surveyed

Department of Commerce to Study Industrial Equipment with Object of Improving Users' and Manufacturers' Economic Status

THE Department of Commerce is about to undertake a requested study of industrial equipment, it was announced this week. One of the objectives of this study, which will be conducted by the domestic commerce division, under immediate direction of H. C. Dunn, is to determine the amount of obsolete equipment and its importance as a factor in the inability of firms manufacturing similar products to compete on an equally profitable basis. Information will be sought which will indicate the advisability or inadvisability of replacing machinery which may have many years of usefulness but which has not kept pace with style changes or inventive genius.

Mr. Dunn explains the objects and plans for the industrial equipment survey as follows:

"It would seem that there would be two important phases of the industrial equipment study; one, to bring out facts that show obsolescence to be an important factor in production costs, and another, which should follow as a natural consequence, the importance of correctly evaluating and providing for obsolescence in cost accounting.

"The first result would probably best be attained by a comprehensive study among manufacturers of machinery of the history of specific machines. Perhaps a study of the manufacturer's sales records would reveal whether a machine was purchased to replace one that had become inadequate by obsolescence or by physical condition. These developments would be studied for the further purpose of determining the standard, under the various conditions of production, against which machines could be measured for obsolescence.

"The second phase of the study would involve the enumeration of the machines in the users' plants of whatever industry or industries selected. The census of the machines in use would probably include such questions as the type, model and size of the machine, floor space occupied, the productivity of the machine, age of the machine, power consumption, repairs and rejects

of its product. These items are tentative as yet. The final questionnaire will be decided upon after study by the advisory committee."

New British Power Plan $100,000,000 Project

Area of 9,082 Square Miles Covered by Development to Be Completed in 1940—Number of generating stations to be cut

DETAILS of the fourth scheme in connection with national reorganization of British electricity supply have just been reported. The scheme deals with northwest England. The three previous schemes approved by the Central Electricity Board dealt with central England, southeast England and central Scotland.

The latest plan will involve a capital outlay of $100,000,000 and will be completed in 1940. An area of 9,082 square miles is involved. Generating costs in this area are now low, but it is estimated that a saving of more than $13,750,000 will be achieved in five years.

The plan is said to be, industrially, the most important of any yet drawn up in Britain. The Lancashire cotton industry will be linked up with the shipping, chemical and rubber manufacturing centers of West Lancashire, North Wales and Cheshire. Shipbuilding and iron and steel works at Liverpool and Barrow-in-Furness and the coal mines and blast furnaces of Cumberland will be included.

Northwest England is supplied by 122 authorized dealers, owning 70 generating stations. Under the new scheme it is proposed to select 29 existing stations, operate temporarily six stations and close down 35.

French Engineers to Tour United States

A party consisting of twelve French engineers interested in the production and transmission of electricity will leave Paris on Sept. 12 for the purpose of inspecting the outstanding electrical installations of the United States. Arriving in New York on Sept. 18, the party will visit the power systems in New York and vicinity, Boston, Montreal, Toronto, Niagara Falls, Buffalo, Cleveland, Detroit, Chicago, Milwaukee, Butte, Salt Lake City, San Francisco, Big Creek, Los Angeles, St. Louis, Cincinnati, Philo, Washington, Baltimore, Philadelphia and also the works of the General Electric Company and of the Westinghouse Electric & Manufacturing Company at Schenectady and Pittsburgh respectively.

The party will comprise Messrs. Girousse and Groslier of the Northern Central Station Company of Paris, Lucien Feraud, director of the Northeastern Central Station Company of Paris, Georges-Bernard Dreyfus, managing director of the Eastern Distributing Company of Paris, Messrs. Lapeyre and Bres, Messrs. Maurice and François Fougerolles of Fougerolles Brothers, M. Duval, chief engineer of the General Contracting Company, and Lucien Bourrellis, manager of the Central Station of Normandie. It is expected that the tour will require more than a month.

International Commission to Study Large Dams

In view of the recent failures of some large dams with loss of life, the French government has sent invitations to the other governments of the world suggesting the desirability of the formation of an international commission of engineers to study the question of the safety and design of large dam structures. Spain, Roumania and Switzerland have already indorsed the suggestion and a committee has been appointed by the Union Internationale des Producteurs and Distributeurs D'Energie Electrique to make recommendations. It is expected that the American Society of Civil Engineers may act for the United States and that the entire question will clear through the World Power Conference.

International Illumination Congress Itinerary

For the tour arranged for the delegates to the International Illumination Congress to be held at Saranac Lake, N. Y., in September (following the convention of the Illuminating Engineering Society at Toronto on Sept. 22-28) the schedule printed below has been approved:

Friday, Sept. 7—Leave New York about 9 a.m. for Boston.

Saturday, Sept. 8—Leave Boston about 10 p.m., to arrive in Philadelphia about 9 a.m., Sunday.

Sunday, Sept. 9—Leave Philadelphia about midnight for Washington.

Monday, Sept. 10—Arrive at Washington about 8 a.m.; leave about 10 p.m. for Cleveland.

Tuesday, Sept. 11—Arrive Cleveland about 1 p.m.

Wednesday, Sept. 12—Leave Cleveland for Detroit about midnight.

Thursday, Sept. 13—Arrive Detroit 8 a.m.; leave about midnight for Chicago.

Friday, Sept. 14—Arrive Chicago about 8 a.m.

Saturday, Sept. 15—Leave Chicago about 5 p.m. for Niagara Falls.

Sunday, Sept. 16—Arrive Niagara Falls about 9 or 10 a.m.; leave midnight or later for Toronto, to arrive there 8 a.m. Sept. 17.

Colorado River Survey Action Anticipated

Announcement has been made that the Colorado River Commission will hold its first meeting in Washington on July 30 to organize the study and to determine whether or not existing records contain the fundamental engineering data needed for its deliberations. It is expected that the commission will find that existing data are sufficient on which to base the studies of the problems involved at the Boulder site, but there is doubt of the adequacy of the information concerning dam sites in connection with alternative projects.

It is recognized that two of the important problems which the commission must undertake are concerned with the construction work encountered in the canyon in the short working season available and with the checking of the cost estimates. Arrangements are being made in Washington for clerical help.

Purchases and Mergers

ACQUISITION by the American Community Power Company of virtually all the common stock of the General Public Utilities Company is announced. The latter company, organized three years ago and since then under the general direction of Day & Zimmermann, Philadelphia, controls the Consolidated Power & Light Company of Deadwood, S. D.; the Gulf Public Service Company of Jacksonville, Tex., and the Southwestern Public Service Company of Amarillo, Tex., and Carlsbad, N. M. The American Community Power Company is a subsidiary of the American Commonwealths Power Corporation and has also acquired all the parent company's stock in the Community Power & Light Company of St. Louis, of which the Arkansas Utilities Company, Helena, Ark.; the Community Power & Light Company of Texas, Mexia, Tex.; the Kansas Utilities Company, Fort Scott, Kan.; the Missouri Utilities Company, Sikeston, Mo.; the new Mexico Utilities Company, Clovis, N. M., and the Texas Utilities Company, Plainview, Tex., are subsidiaries.

The Ohio Electric Power Company has acquired the Citizens' Light & Power Company, serving the towns of St. Johns, Uniopolis, Holden, Gutman, Santa Fe and West Manchester, Ohio.

The municipally owned water and light plant of the town of Norman Park, Ga., has been purchased by the Baker County Power Company, which is controlled by the W. B. Foshay Company, Minneapolis.

Purchase of the Silverdale Light & Power Company by the Puget Sound Power & Light Company has been completed and operation under the new ownership began July 10. The territory includes the towns of Silverdale, Chico, Brownsville, Illahee, Tracyton, Scandia, Bangor and Seabeck.

The newly formed Southeastern Indiana Power Company has purchased certain properties of the old Indianapolis & Cincinnati Power Company, in accordance with the terms of a receivership sale previously authorized in court orders. The purchase has been approved by the Indiana Public Service Commission.

The West Tennessee Power & Light Company has filed a copy of its charter with the Secretary of State in Nashville, Tenn. A consolidation of sixteen light, power, ice and affiliated companies is involved. Ultimate plans call for complete electrification of homes in West Tennessee. It is said to be probable that the new organization will be supervised by the Electric Bond & Share Company.

Pacific Coast A.I.E.E.

Diversified Program Adopted for Spokane Convention Next Month—Institute Will Also Have Regional Meeting at Atlanta in Last Days of October

WHEN the Pacific Coast convention of the American Institute of Electrical Engineers is held at Spokane, Wash., on Aug. 28-31 a well-diversified program of technical papers will be presented. Final details are yet unsettled, but a tentative list of the papers has been drawn up as follows:

"The Electrolytic Zinc Plant of the Sullivan Mining Company," E. R. Fosdick, Washington Water Power Company.

"Great Northern Railway Electrification," R. D. Booth and E. L. Moreland, Jackson & Moreland.

"Power Supply for Railway Signals and Automatic Train Control," C. F. King, Westinghouse Electric & Manufacturing Company.

"Movements of Overhead Line Conductors During Short Circuits," William S. Peterson, Los Angeles Bureau of Power and Light, and H. J. McCracken, Jr., Dept. of Water and Power, city of Los Angeles.

"Economy in the Choice of Line Voltages and Conductor Sizes for Transmission Lines," E. A. Loew, University of Washington.

"Generalization of Transmission-Line Diagrams," H. V. Carpenter, Washington State College.

"Technical Features of Inductive Coordination from the Power Man's Standpoint," L. J. Corbett, Pacific Gas & Electric Company.

"Calculation of Single-Phase and Three-Phase Short-Circuit Currents on Systems Under Load," R. H. Park and E. H. Bancker, General Electric Company.

"The Automatic Substation and Its Relation to the Electric Distribution System," S. J. Lisberger, Pacific Gas & Electric Company.

"Calibration of the Point Gap for Measurement of the Crest Values of 60-Cycle Voltages," J. S. Carroll, Stanford University.

"Heat Flow from Underground Electric Power Cables," N. P. Bailey, University of Idaho.

"Vacuum-Tube Applications in the Light and Power Industry," L. F. Fuller and W. A. Tolson, General Electric Company.

"Some Problems in Power-Line Carrier Telephony and Apparatus Recently Developed to Meet Them," C. F. Boeck and R. D. Gibson, Bell Telephone Laboratories, Inc.

"New Light on Lightning Problems from Klydonograph Studies," A. L. Atherton, Westinghouse Electric & Manufacturing Company.

"Cable Corrosion in Creosoted Wood Duct," R. M. Burns, Bell Telephone Laboratories, and B. A. Freed, Pacific Telephone & Telegraph Company.

"Carrier Telephone System for Short Toll Circuits," H. S. Black, Bell Telephone Laboratories, M. L. Almquist and L. M. Ilgenfritz, American Telephone & Telegraph Company.

Another regional meeting has been scheduled by the Institute for this year. It will be under the direction of the Southern District and will be held in Atlanta at the Hotel Biltmore on Oct. 29 to 31.

New Ruling Made on Federal Power Board Personnel

The fact that the Federal Power Commission has been authorized to pay from its own appropriation "the salaries of all civilian employees whose service with the commission has become permanent through detail from any executive department" does not relieve the War, Interior and Agricultural Departments from the responsibility of performing any necessary work which has been performed by those departments in the past, the Comptroller-General has ruled.

The water-power act provides that the work of the commission is to be performed by and through the three departments mentioned and that they are to furnish the necessary engineering, technical, clerical and other help needed. There is a feeling in the departments that the intent of Congress in allowing the commission to pay directly the staff it has been employing was to preclude further drafts upon the departments for clerical help. There also is a feeling that there is a tendency on the part of the commission's staff to take over work that Congress intended the departments themselves to do, and some believe it could be done there effectively and economically. It is expected that the matter will be brought before the comptroller again before further employees are loaned to the Federal Power Commission.

Cedar Point Meeting Looks to Future

East Central Division of National Electric Light Association Considers Problems of Public Policy, Engineering and Commercial Activities

A VIGOROUS repudiation of charges alleging social and economic crimes resulting from private ownership and operation of electric untilities was the main theme of the address of P. S. Arkwright, president of the National Electric Light Association, to the East Central Division, N.E.L.A., convention at Cedar Point, Ohio, July 10-13. After briefly sketching the growth of the industry, Mr. Arkwright dwelt at greater length on the social and economic changes that have resulted from and accompanied this growth. Electricity costs to users have steadily decreased through the history of the industry and at the present time electric power is equivalent to man power at $4 per year on the average, he stated. Population is spreading out over larger and thinner industrial areas as the result of the availability of electric power, this condition making for better, healthier and happier lives of industrial workers. An electricity supply system, whatever its extent, financially and physically, is essentially of local character, manifesting that character in local improvements, local payrolls and local taxes, according to Mr. Arkwright. The watered stock of electric utilities is wholly a myth, there being on the average $1.38 in used and useful property for every dollar of capitalization. It was Mr. Arkwright's contention that the so-called propaganda methods of public utility information bureaus were and are necessary so long as no one can find a better way of fighting the devil than with his own weapons. The holding company as an instrument for the development of properties otherwise unable to assume and carry their proper responsibilities in their communities has its honorable place in the scheme of things.

H. J. Gondon, editor of the *Public Service Magazine*, spoke on "The Mythical God of Public Ownership." He asserted that only one in one hundred of municipal projects was making good in service and returns. He characterized as dangerous by-products of municipal ownership those mistaken enthusiasms and false statements that apparently are not related to the actual performances of such projects. Harm to business may be done by these by-products; the records of fact need not be feared.

The results of efforts toward accident prevention and plans for increasing the pressure of that effort were the subjects at the opening of the second session of the convention. The work of the accident prevention committee in the East Central Division was explained by its chairman, W. A. Buchanan. Other addresses of various phases of this activity were presented by George Opp, C. J. Rutland and W. E. Kearns. The latter half of this session was given over to accounting and this part was sent off to an inspiring start with a talk by E. Kelsey, Toledo, on "Assets Not Appearing in the Book." B. C. Taylor, chairman of the accounting committee, reported its accomplishments during the year, and F. W. Herbert, N.E.L.A. headquarters staff, stressed the growing importance of accountancy in central stations, the diversity of demands on it and its responsibility in the utility structure.

An open meeting of the convention, presided over by H. W. Derry, was held in the evening of the first day. Features of this meeting were a resuscitation playlet put on by girls from the Wheeling Electric Company, an illustrated lecture on progress in artificial lighting by Harry C. White and motion pictures of industrial electric heat applications.

The Engineering Session

The session devoted to engineering, under the chairmanship of C. L. Proctor, covered several interesting phases. The work of the section in regard to operation of transmission lines, networks, wood pole lines, crossings and road improvements, system planning, education of new men, stand-by boilers and rotating machinery was sketched by George E. Snider. Following the reports of committees by their chairmen, M. E. Grah, overhead and underground systems; J. F. Hurst, prime movers; M. F. Smalley, meters; H. A. Holmes, inductive co-ordination, and G. W. McIver, electrical apparatus, E. C. Stone, chairman of the Engineering National Section, gave an address. Mr. Stone emphasized the necessity for reducing system investment per unit output. This is largely a selling job, but the engineer can do much by reducing the system cost per kilowatt. He stated that the engineer will be called upon to spend more money on system develop-

ment in the next ten years than ever before and must be ready to accept that responsibility and be capable of discharging it wisely. Mr. Stone drew attention to the present bad and possibly worse future situation in regard to codes affecting electrical construction and design. He strongly urged engineers and executives to study this situation closely so that corrections might be made and future onerous provision be guarded against. In closing, Mr. Stone stated that the engineer must leave his technical isolation and become a scientific business man if he is to take his proper place in utility organization.

Power-plant development, with particular reference to mechanical and steam design, was treated in a paper by George W. Saathoff. Diversity of fuels, developments in boilers and extensions of heating surfaces, increases in sizes of turbine units, tendencies to reduce the number of steam-driven auxiliaries and the necessity for simplification of power-plant design featured the paper. W. E. Hill, chairman of the national meter committee, undertook to explain the "why" of meter committees in his address and he made out a good case. The engineer's responsibilities to management were stated to be a supplement and extension of managerial functions in a paper by E. J. Burger. Prof. A. M. Wilson delivered an interesting talk on engineering education, in which he said that not enough attention was given to the job of discovering natural capacities in individuals in our present educational methods.

Commercial Men Get Suggestions

At the session given over to the commercial men, presided over by G. E. Miller, the high point of interest was the talk by Ernest Greenwood. He said that three subjects should occupy the minds of commercial executives. The first of these was selling in competition with other industries; the second, synchronization of selling effort, and the third, preparedness. By preparedness he meant the necessity for the industry so to extend the uses of electricity among the people that its benefits and value under private ownership would be an effective answer to socialistic agitation.

Merchandising of electric ranges was covered by two speakers, H. H. Davis and W. A. Dannenhauer. Power-factor correction, electric water heating and high temperature electric furnaces were subjects of papers by G. A. Wills, A. H. Clark, H. N. Shaw, respectively.

Public relations and rural service were the subjects of the two last sessions of the convention. At the first of these W. R. Power spoke on the importance of public relations, following which Paul S. Clapp gave an address on "What We Are Doing and Where We Are Going." The accomplishments of the educational committee were recited by A. Bliss McCrum and the women's share in the industry was the subject of talks by Misses Esther Rockey and Eloise Davidson. At the rural service meeting the problems, perplexities and advantages of this class of business were explained by J. B. Johnson and the experimental line was discussed by Prof. J. W. McCuen. The "Future of Rural Service" by I. F. Blauser, "Pennsylvania Order No. 28" by Louis B. Round and "What the Farmers Want" by C. A. Dyer closed the session.

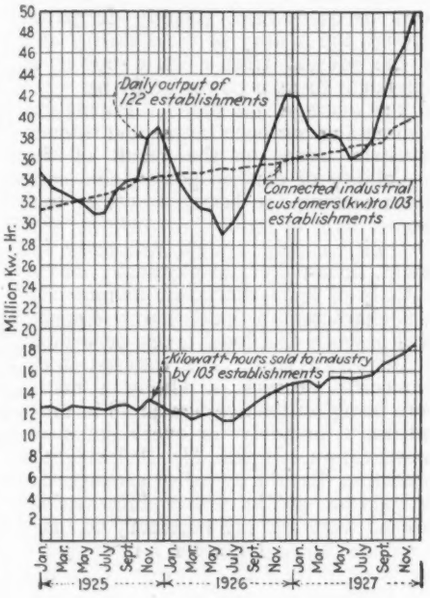
An exhibition in which 72 manufacturers and manufacturers' agents were represented added much to the value of the meeting. The total registered attendance was more than 1,000. New officers elected were: C. S. McCalla, president; L. B. Herrington, first vice-president; G. E. Miller, second vice-president; C. H. Hardesty, third vice-president, and D. L. Gaskill, secretary-treasurer.

Growth of German Electrical Industry

One Hundred and Three Generating Plants Show Total Increase of 20 per Cent in 1927 Over 1926—Total Yearly Output for Nation Is 25,000,000,000 Kw.-Hr.

News-letter from Dr. Gerhard Dehne

After the census of 1925, the *Statistische Reichsamt* undertook to follow up the monthly output of 122 electrical establishments in Germany and, in the case of 103 establishments, to keep a record of the energy sold to industry and of the installed kilowatts of the industrial customers. These establishments generated 10,400,000,000 kw.-hr. in 1926 and 12,500,000,000 kw.-hr. in 1927, an increase of 20 per cent; they account for about half of the entire German output, estimated roughly at 25,000,000,000 kw.-hr. during 1927. The continuous growth in connected load, the upward trend in output as well as in industrial energy consumption, the seasonal fluctuations due to the lighting load and the effect of the economic depression of 1926 are shown in the accompanying chart.



Output of some German utilities and trend of industrial sales

An individual example of rapid development is that of the Berlin Electric Works, which nearly quadrupled its output in twelve years, notwithstanding the dislocation caused by the war and post-war period. Founded in 1884 by the German Edison Company, later the A.E.G., it was purchased by the city in its exercise of the privilege of so doing in 1915, when the output amounted to 270,000,000 kw.-hr. and the installed capacity to 160,000 kw. During the period of monetary inflation and scarcity of fuel the municipal plants were linked by 110-kv. transmission lines with plants of the "Elektrowerke" in the lignite fields, 85 miles distant.

In 1923 the company was changed into a stock company, the shares being entirely owned by the city. In response to the rapid increase of the demand for energy, the Klingenberg plant, operated with pulverized coal, was begun in 1925 and the first unit put into operation in 1926. Its present capacity is 270,000 kw. Altogether the company operates six generating plants, with an aggregate rating of 516,200 kw. and an output during 1927 of 699,200,000 kw.-hr. The sum of generated and purchased energy exceeded 1,000,000,000 kw.-hr.; sales amounted to 912,800,000 kw.-hr.

Analysis of the probable growth shows that by 1932 an addition of 465,000 kw. will be required, thus virtually doubling the present installation. Provisions for meeting this situation include an increased use of existing storage batteries, the installation of a new 40,000-kw. Ruths steam accumulator in the Charlottenburg plant, an increase in the power purchased from the Elektrowerke to 50,000 kw. during the winter peak, and the construction of a new plant in the western part of Berlin similar to the Klingenberg plant. This is to be begun during 1928 and put into initial operation during 1930. The cost of all the new work definitely planned is estimated at $23,300,000.

The chief plant of the Elektrowerke, previously mentioned, is the Golpa-Zschornewitz in the lignite fields, with an initial capacity of 128,000 kw., constructed in nine months of 1915 to supply energy to a large calcium-nitrate plant, and subsequently enlarged to 230,000 kw. The entire system has a present rating of 408,000 kw., comprises an extensive 110-kv. network connecting with similar high-tension networks of adjacent systems and

serves Berlin by way of four 110-kv. lines.

The output of the Elektrowerke was 1,670,000,000 kw.-hr. in 1927, compared with 1,480,000,000 kw.-hr. in 1926. Of the output in 1927, 30 per cent was furnished to a calcium-nitrate plant and 15 per cent to the aluminum industry. American capital participated in the development of this system through the flotation in April of a loan of $5,000,000 through Harris, Forbes & Company, Brown Brothers & Company and Lee, Higginson & Company.

Progress in the electrical manufacturing industry is shown by the record of the Siemens concern, which is one of the two establishments dominating the industry today, the other being the A.E.G. The Siemens concern was established 25 years ago by the consolidation of two much older organizations. Of these, the Siemens-Halske now does the low-tension business and the Siemens-Schuckert Works execute the high-voltage orders. Before the war the dividends regularly amounted to 12 per cent. After the inflation they again rose to 12 per cent, from 6 per cent in 1924. Together they have more than 110,000 employees, 60,000 in the main factories near Berlin.

Aside from important subsidiaries in Germany, the Siemens concern is heavily interested in various foreign companies.

Surveys Industries Pending Hydro Approval

The New England Power Association is planning to make an industrial survey of New Hampshire in order to stimulate the location of new concerns in that state. The move is in anticipation of the hydro-electric development at Fifteen-Mile Falls on the Upper Connecticut River, involving a $40,000,000 expenditure.

Permission is yet pending for the project, which will be the largest power development, if it goes through, east of the Mississippi River, with the exception of the one at Niagara Falls. The industrial survey would indicate that the company prefers to develop a New Hampshire market for its power and would serve the potential industries to locate there through substations.

Central Heat to Be Supplied by Baltimore Utility

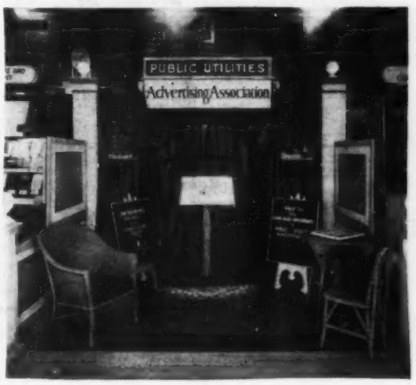
The Consolidated Gas, Electric Light & Power Company of Baltimore has recently acquired control of the property and business of the Terminal Freezing & Heating Company. In announcing its intention to engage in the business of operating a modern steam-heating system for Baltimore's business district the Consolidated company made the following statement:

"Our purpose in this acquisition is to provide, for the central business section of Baltimore, a steam-heating system generally available to business houses and buildings in this section, with rates for service which will be attractive as compared with the cost of operating individual heating plants. Heretofore the service of the Terminal company has been limited to a comparatively small district, and it is our intention to extend and reinforce the steam mains as rapidly as the demand justifies."

Utilities Advertising Men Convene in Detroit

New Sample "Copy" Book Distributed —Many Aspects of Public Service Company Advertising Discussed— Babson Defends the Monopolistic Principle

ONE HUNDRED advertising men and women attended the Public Utilities Advertising Association meetings at the International Advertising Association convention, Detroit, July 8 to 12. The Public Utilities Advertising Association presented to its membership its new book on public utility advertising, containing 650 advertisements



Public Utilities Advertising Association booth at Detroit

selected from 4,000 submitted by every important company in the United States and also by Canadian and European companies. The book is a result of the "better copy" contest sponsored jointly by the N.E.L.A. and the P.U.A.A. and has received the official indorsement of the N.E.L.A. It is being sold to all public utilities in the interest of better advertising and makes available to every user a cross-section of successful "copy" used throughout the industry. The contents include sections devoted to electricity, transportation, gas, the telephone and water, and they cover in their respective fields commercial activities, merchandising, institutional matters and customer ownership. Names of the winners of the "better copy" contest in the electrical division were given last week on page 82. First, second and third prizes went respectively to the Edison Electric Illuminating Company of Boston, the Virginia Electric Power Company of Richmond and the New Orleans Public Service Company.

Other features on the program included a discussion of reactions from the broadcasting field by Frank A. Arnold, National Broadcasting Company, New York; a discussion on budgeting and accounting for advertising expenditures led by L. D. Gibbs, Edison Electric Illuminating Company of Boston and participated in by T. D. Pfeiffer, Byllesby Engineering & Management Corporation, Chicago, and J. C. Costello, Tennessee Electric Power Company, Chattanooga, and a third discussion on "Are Advertising Costs in Line?" led by E. Frank Gardiner, Midland Utilities Company, Chicago, followed by L. K. Starr, Georgia Railway & Power Company, Atlanta, and T. H. Kettle, Northern States Power Company, Minneapolis.

"Direct Mail Opportunities for Public Utilities" were described by Homer J. Buckley, Buckley-Dement Company, Chicago; William H. Hodge, chairman of the committee on contact with stockholders, reported on that topic, and a discussion on "How Shall We Advertise Our Merchandise?" was led by Clara H. Zillessen, Philadelphia Electric Company, Dorothy B. Fisher of Chicago, Dorothy Dignam of Chicago and Maurice Jacobs of Omaha taking part. Another event was a symposium on publicity practices.

Three new directors of the P.U.A.A. were elected—D. M. Mackie, W. H. Hodge, and J. M. Bennett. Jay Barnes of the New Orleans Public Service Company is the new president of the public utility advertising group, and Irving M. Tutuer is the newly elected third vice-president. The retiring president is Donald M. Mackie of the Allied Power & Light Company.

Of interest on the general program of the International Advertising Association were an address by P. H. Gadsen, vice-president of the United Gas Improvement Company of Philadelphia, and an address by Roger W. Babson of Babson's Statistical Organization. Mr. Babson defended monopoly as making for general prosperity and instanced the electric power industry as a case in point.

Transatlantic Radio Averages 35 Messages Daily

An authorized statement, just made, says that transatlantic telephone service, first given between the United States and Great Britain, has gradually been extended until now in addition to these original countries it reaches Belgium, Holland, Germany, Sweden, France, Norway and Denmark on the European Continent, and Canada, Mexico and Cuba in North America. The transatlantic telephone circuit linking the two continents is operated jointly by the American Telephone & Telegraph Company and the British Post Office.

From the opening of service on Jan. 7, 1927, to the close of business on June 30, 1928, a total of 6,775 commercial messages have been handled over the transatlantic telephone link.

The average number of completed messages daily since April 1, 1928, has been 35 and the largest day's traffic has been 61 messages. The service is open from 6:30 a.m. to 10 p.m., New York time, corresponding to 11:30 a.m. to 3 a.m., London time.

Electragists Complete Plans for Chicago Meeting

The twenty-eighth annual convention of the Association of Electragists International will be held at the Stevens Hotel, Chicago, Ill., Aug. 6 to 10. A program with many special features and supplementary entertainment for the ladies and children has been planned. The following reports, addresses and activities are among those scheduled:

Monday—Registration.

Evening—Executive committee session.

Tuesday—Business session for contractors and contractor-dealers.

Reports upon electragists and architects' filing system for manufacturers' catalogs by committee chairman and an address by S. B. Williams, "Wasted Profits."

Wednesday Morning—General convention session. President's message—Clyde L. Chamblin; "Are Public Utility Merchandising Methods Fair," Philip Cabot; "Manufacturer's Plans for Appliance Distribution Studies," Merrill C. Morrow; "Some Thought on Motor Distribution," E. O. Shreve, and "The New Co-operation," L. K. Comstock.

Afternoon—Business session for contractors and contractor-dealers. Discussion and action upon merchandising and wiring policies; committee reports; labor section meetings.

Evening—General assembly, "A Mid-Summer Night's Dream," John F. Gilchrist and entertainment.

Thursday Morning—General session. "The Present Trend of the National Electrical Code," Victor H. Tousley; "Credit and Credit Policies," Frederic P. Vose; "Boston Edison-Contractor-Dealer Partnership," J. J. Caddigan.

Evening—Annual banquet and entertainment.

Friday Morning—General session. "State Enabling Acts and Licensing," H. B. Kirkland; report of national motor section and of special committees and award of 1928 James H. McGraw Contractor-Dealer Medal.

Human Relations in Industry Conference at Lake George

The eleventh annual conference on Human Relations in Industry will be held Aug. 29-Sept. 2, 1928, at Silver Bay, Lake George, N. Y., under the auspices of the industrial department of the National Council of the Young Men's Christian Association.

Leaders from many fields of activity will speak, including Prof. Michael Pupin, Columbia University; P. Whitwell Wilson, former member of the British Parliament; William J. Graham, vice-president Equitable Life Assurance Society; Riley M. Little, chief of the Bureau of Rehabilitation, New York State; R. N. Van Doren, vice-president Chicago & Northwestern Railway; Howard Coonley, president Walworth Company, and C. H. Flint, chancellor of Syracuse University. Arthur H. Young, Industrial Relations Counselors, Inc., New York, is chairman of the conference.

Briefer News

SOUTHEASTERN DIVISION, N.E.L.A., APPOINTS OFFICERS. — The following officers of the Southeastern Division, National Electric Light Association, were elected at the meeting of the executive committee in Atlanta, Ga., on July 12: First vice-president, T. H. Tutwiler, Memphis Power & Light Company, Memphis, Tenn.; second vice-president, H. E. Cox, Birmingham Electric Company, Birmingham, Ala.; third vice-president, J. V. Strange, Carolina Power & Light Company, Raleigh, N. C. C. A. Collier, president of the Southeastern Division, made the following appointments: Treasurer, Miss Ruth Morris, Georgia Power Company, Atlanta, Ga.; auditor, H. J. Woodard, Georgia Power Company, Atlanta, Ga.

PACIFIC GAS & ELECTRIC APPLIES FOR MORE WATER FROM BEAR RIVER.—The Pacific Gas & Electric Company has asked the California authorities for permission to divert 525 additional cubic feet of water per second from the Bear River in Placer and Nevada Counties. The company is understood to be contemplating a development which, at an estimated cost of $7,500,000, will add two power houses to the system now fed by Lake Spaulding.

PROGRESS OF CHELAN (WASH.) DEVELOPMENT.—An agreement providing that each company will build part of the 110-kv. transmission line between the Chelan power station of the Washington Water Power Company and the town of Wenatchee, Wash., on the line of the Puget Sound Power & Light Company, has been announced by the two power companies. The line will be about 40 miles long and the survey work is complete. The Washington company's second unit of 32,200 hp. is expected to go on the line next month.

CENTRAL ONTARIO PLANS EXPANSION OF SYSTEM.—Further expansion of the system of public ownership of power distributing plants in central Ontario was urged in a resolution adopted at a meeting of the Central Ontario Power Association held in Cobourg, Ont., on July 12. The recommendations of this body were as follows: (1) That all municipalities within the central Ontario power zone that have not yet entered upon such obligation shall assume ownership of the local electrical distributing systems; (2) that such municipalities be requested to negotiate with the Hydro Commission of Ontario to ascertain the price at which local distributing plants may be secured; (3) that a vote of the ratepayers be taken upon the advisability of purchasing the local distributing plants.

CANADA PROVIDES FOR ENGLISH RIVER DEVELOPMENT.—Announcement has been made that the Ontario government will proceed at once with the erection of a storage dam and power house at Ear Falls on the English River. All engineering details will be in charge of engineers of the Ontario Hydro-Electric Power Commission. The building of the storage dam will be carried out under an arrangement between the Dominion, Ontario and Manitoba governments whereby the federal government, which controls the natural resources in Manitoba, assumes three-fifths of the cost of the dam and the Ontario government pays two-fifths, these proportions representing the respective benefits to Manitoba and Ontario of storage control of the flow of the English and Winnipeg Rivers. When the power house is completed, the Ontario government expects to supply

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association—Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers—Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Maryland Utilities Association—Braddock Hotel, Braddock Heights, Md., Sept. 7. D. E. Kinnear, 1005 Continental Bldg., Baltimore.

Western Section, International Association of Electrical Inspectors—Cosmopolitan Hotel, Denver, Sept. 10-12. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Illuminating Engineering Society—Toronto, Can., Sept. 17-20. L. H. Graves, 29 West 39th St., New York.

Rocky Mountain District, N.E.L.A.—Hotel Colorado, Glenwood Springs, Sept. 17-20. (With Colorado Utilities Association.) O. A. Weller, Public Service Co. of Colorado, Denver.

Empire State Gas and Electric Association—Saranac Inn, Upper Saranac, N. Y., Sept. 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Sept. 22-28. J. W. Welsh, 292 Madison Avenue, New York.

International Committee on Illumination, Saranac Inn, Lake Saranac, N. Y., Sept. 22-28. (See Illuminating Engineering Society.)

New England Section, N.E.L.A.—Poland Springs House, South Poland Springs, Me., Sept. 24-27. Miss O. A. Bursiel, Statler Bldg., Boston.

Great Lakes Section, N.E.L.A.—French Lick Springs, Ind., Sept. 27-29. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

power for mining in the Red, Woman and Narrow Lakes fields, as well as for any paper manufacturing that may take place in the region. Legislation providing for the agreement under which the Dominion and provincial governments will act was proclaimed by both governments on June 30.

STATION DESIGNED ENTIRELY FOR HIGH PRESSURE.—The new station of the New Jersey Power & Light Company at Holland, N. J., referred to in a recent issue, will be the second to be designed entirely for high-pressure (1,200-lb.) steam generation, the Deepwater station, opposite Wilmington, Del., announced a few months ago, being the first. In both stations General Electric turbo-generating units will be installed. The initial installation at Holland will consist of a 55,000-kw. turbo-generating unit of the cross-compound type, comprising a high-pressure and low-pressure turbine with boiler reheat between them. The high-pressure machine will turn at 3,600 r.p.m. and will operate directly from the 1,200-lb., 725-deg. F. mains. It will discharge into a crossover line which will return the steam to the boiler for reheating to 750 deg. F. From the reheater the steam will be returned to the turbine room and will flow through the low-pressure unit, which will be designed for 1,800 r.p.m. and will exhaust against a back pressure of 1 in. absolute. Both units will deliver power at 13,800 volts.

RURAL DEVELOPMENT LAGS IN NEBRASKA.—Although the Nebraska Power Company, the Iowa-Nebraska Light & Power Company and others of the larger electric utilities in Nebraska have begun to develop rural service, so far only 2,200 of the 124,000 farms in the state have electricity, according to a survey recently completed by E. E. Brackett, head of the agricultural engineering department of the University of Nebraska. Of this number 1,200 buy from public service companies and the remainder from municipal plants or intertown publicly owned lines. Mr. Brackett finds that the average cost of supplying rural service is $1,000 a mile, which includes pole line, transformers and service lines. The service is furnished below cost. For all companies the average annual revenue per customer was $49.32, or about 5 per cent on the investment. The revenues vary greatly, from an average of $28.14 per customer to $1.94, with $30 about the average per company. The average number of customers to the mile was 2.84, ranging from one to four. No companies have the same rate owing to different methods, different quantities consumed on the average by customers and wide variation on extent of construction necessary to reach them. Data for eleven companies were studied and showed that the average of all for one year of service was 9.47 cents per kilowatt-hour. One company with 25 subscribers averaged 15.3 cents and another with 324 averaged 5.87 cents.

Recent Court Decisions

CONTRIBUTORY NEGLIGENCE A MATTER FOR JURY.—Downey vs. City of Macon was a suit for damages due, as alleged, to the escape of electricity at dangerous voltage over a drop cord attached by plaintiff to the city's distribution lines. The defendant held that the electrical connection made by the plaintiff was of a crude description and that the accident was due to his own negligence. The Kansas City Court of Appeals, however, held that the jury was within its rights in deciding otherwise and that the undisputed injuries to the man brought the case under the rule of *res ipsa loquitur* ("the thing speaks for itself"). (6 S.W. [2d] 63.)*

COMPANY NOT LIABLE FOR INJURY CAUSED BY ITS LOOSE SIGNAL WIRE COMING IN CONTACT WITH LINE OF ANOTHER.—In Salwiecz vs. Rutland Railway, Light & Power Company and Vermont Hydro-Electric Corporation, a damage suit for injuries to a child from contact with a hanging signal wire of the defendant first named, which touched the high-tension wires of the other defendant, the Supreme Court of Vermont sustained a directed verdict for the first defendant but reversed a similar finding for the second defendant. The court found that a company which simply owned unused signal wires and had no interest in the transmission line was not liable. On the other hand, the fact that escaping electricity from its high-voltage lines injured a child established a *prima facie* case against the Vermont Hydro-Electric Corporation which the trial judge should not have taken from the jury. Though the company was not an insurer as regarded the child, whether or not the latter was trespassing on the land of a third party could not affect the question of liability. (142 At. 77.)

TELEPHONE COMPANY CUTTING ELECTRIC SERVICE COMPANY'S GUY WIRE A WRONGDOER.—Johnson vs. East Texas Public Service Company was a suit for damages because of injuries sustained from touching a hook suspended from an electric light pole, the hook having become heavily charged owing to the Southwestern Bell Telephone Company, which the defendant interpleaded, having cut a guy wire belonging to the defendant which had been unmolested for fifteen years, the said wire having fallen across the transmission lines and caused a short circuit. The Commission of Appeals of Texas held that the telephone company was guilty of active wrongdoing and negligence as between it and the electric service company. It therefore, while upholding a verdict for the plaintiff, reversed a finding for the telephone company on the cross-bill and ordered a retrial as to the liability of that company to reimburse the other for the damages assessed. (6 S.W. [2d] 344.)

MEASURE OF DAMAGE FOR LAND TAKEN UNDER FLOWAGE ACT.—In Emmons vs. Utilities Power Company the plaintiff brought petition under the flowage act for the assessment of damages to her land overflowed by the defendant's dam built across the Pemigewasset River in the town of Bristol, N. H. The land is situated on the westerly bank of the river and extends for a distance of over a mile thereon. In that distance there is a fall of between 22 ft. and 26 ft. The dam with flashboards is 55 ft. high and raises the level of the water along the entire length of plaintiff's land. It appears to be conceded that the defendant owned the site of its dam and all of the riparian land affected by the flowage except the plaintiff's. A verdict for the plaintiff, after a jury trial, was given for $5,000. Plaintiff, unsatisfied, excepted to the exclusion of evidence, to the charge made by the trial court and to its refusal to make certain charges as requested by the plaintiff. In granting a new trial the Supreme Court of New Hampshire held that damage for taking land under the flowage act is the difference between the value of land after its flowage and what it would have been worth on date of taking if the dam had not been built. Cases cited, the court said, "fully sustain the conclusions we have reached, namely, that the plaintiff, in the proof of the market value of her land, is not restricted to evidence of its value for development within itself, but afford no basis for the plaintiff's position that she is entitled to share in the enhancement of the value of constituent properties accruing to the defendant by reason of the union which it has effected." (141 At. 65.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

CONSUMER ON WHOSE PREMISES A "JUMPER" WAS USED COMPELLED TO PAY FOR LOCKED METER BOX.—Holding that when a meter has been found to be tampered with it would be unjust to force the utility to continue service to the premises without providing protection against a repetition of the offense, the Missouri Public Service Commission in a case where a customer of the Union Electric Light & Power Company of St. Louis profited from the use of a "jumper" to divert energy from registration, compelled the customer to pay the expense for a locked meter box before service was resumed.

STATE HAS NO DUTY TO ASSIST COMPANY TO MAKE PROFIT.—In determining rates for the West Ohio Gas Company the Ohio Public Utilities Commission said: "The responding company contends that it shall be assisted to the extent of the powers of the state in the earning of a profit upon its investment. In the light of the testimony and record before us we must take sharp issue with this contention. The state did not impose upon the owners the burden of making this investment. As a matter of fact, the capital here employed first appeared in the guise of a suppliant for the right to occupy the public ways with its apparatus. If it now develops that the promotion was ill advised, the owner cannot, in justice, ask the people to contribute an unreasonable wage to render the operation profitable. It is perfectly apparent that the construction of this plant in this territory pre-empts it. The community in interest withholds from the public any duplication of investment which would give to the people the benefits of a competitive battle for this patronage. To all intents, the enterprise enjoys a practical monopoly. This being so, it cannot escape the burden of the Ohio law, 'the furnishing of its service at a just and reasonable rate.'"

News About Men of the Industry

D. S. Kimball Receives New Honor

Dexter S. Kimball, who was elected president of the Society for the Promotion of Engineering Education, as announced in the July 7 issue of the ELECTRICAL WORLD, has been dean of the college of engineering of Cornell University since 1921. Throughout his engineering career Professor Kimball has combined his academic duties with actual engineering practice, in this way keeping in close touch with the most recent developments and movements of his profession.

A native of New Brunswick, Canada, and a graduate of Leland Stanford, Jr., University, he served his apprenticeship with Pope & Talbot, Port Gamble, Wash., and with the Union Iron Works,

D. S. Kimball

San Francisco. After an association with the Anaconda Mining Company as designing engineer he joined the teaching staff of Sibley College, Cornell University, where he remained three years. He relinquished this educational occupation to become works manager of the Stanley Electric Manufacturing Company, Pittsfield, Mass., but in 1904 he returned to Cornell University as professor of machine design and construction, and since 1915 he has held the chair of industrial engineering. Early in 1921 he became dean of the college of engineering. Professor Kimball aided in organizing the Federated American Engineering Societies, is a past-president of the American Society of Mechanical Engineers and is active in other scientific organizations. He is the author of "Plant Management," "Principles of Industrial Organization" and other works and is a frequent contributor to the technical press.

L. A. MCGRAW of Macon, Ga., has been named vice-president and general manager of the South Carolina Power Company, Charleston. Mr. McGraw will be in active charge of the company's affairs, taking over the duties of Stuart Cooper, who resigned as president. Both these properties are subsidiaries of the Southeastern Power & Light Company. Mr. McGraw was also made a director of the South Carolina company. M. S. Lewis of Charleston was chosen secretary. Mr. McGraw for several years has been executive vice-president of the Central Georgia Power Company, the Macon Railway & Light Company and the Macon Gas Company.

F. D. Comerford Heads Rhode Island Company

Frank D. Comerford, president of the New England Power Association, was elected president of the Rhode Island Public Service Company on July 12 at Providence, to succeed Luke C. Bradley, who resigned to affiliate himself with the Electric Bond & Share Company. The ELECTRICAL WORLD named Mr. Comerford as the probable successor to Mr. Bradley in an announcement covering the latter's resignation published in the June 30 issue. A native of Worcester, Mass., and a graduate of Holy Cross College and the Harvard Law School, Mr. Comerford became one of the leading public utility lawyers of New England. In 1926, when the New England Power Association was formed, he was named general counsel and last year he was elected president to succeed Henry I. Harriman, who became vice-chairman of the board.

BLAKE R. VANLEER, assistant professor of mechanical engineering in the University of California since 1920, has been appointed assistant secretary of the American Engineering Council, succeeding A. C. Oliphant, who has resigned. Mr. Vanleer received the degree of B.S. in electrical engineering from Purdue University in 1915 and the M.E. from the same institution in 1922. He took his M.S. in 1919 at the University of California and also studied at the University of Caen, France.

DANIEL W. MEAD, professor of hydraulic and sanitary engineering at the University of Wisconsin for more than twenty years, has been appointed a member of the new Colorado River Commission by Secretary of the Interior Work. In addition to his academic work he has carried on a consulting engineering practice, specializing in hydraulic engineering. Professor Mead has written extensively on water power engineering and has contributed numerous papers at the meetings of various scientific societies, in many of which he holds membership. He is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Consulting Engineers and of other similar organizations.

Dr. Whitney New General Electric Vice-President

Dr. W. R. Whitney, who was elected a vice-president and director of research of the General Electric Company, as announced in the July 14 issue of the ELECTRICAL WORLD, is best known to the engineering profession for his achievement in creating and promoting the research laboratory of the General Electric Company at Schenectady, N. Y., one of the earliest applications of organized research to industry.

Following graduation from the Massachusetts Institute of Technology, Dr. Whitney joined the teaching staff of that institution as assistant professor of chemistry. Later he went to Leipsic, Germany, where he received the degree of doctor of philosophy, and upon his

W. R. Whitney

return to America he was appointed by the General Electric Company director of its research laboratory. The many important developments and inventions made under his direction are indicative of his unusual ability both in executive and in experimental lines. His achievements have won the recognition officially of many institutions of learning and of technical societies through the award of medals and other honors, among which have been the Perkins medal, the Chandler medal and the Willard Gibbs medal, to say nothing of honorary degrees by the University of Michigan, Syracuse University and the University of Pittsburgh. Dr. Whitney is a past-president of the American Chemical Society, the American Electrochemical Society and a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the National Research Council and a fellow of the American Academy of Arts and Sciences.

ROSS W. CRYDER of London, Ohio, has been elected vice-president of the Florida Power Corporation with headquarters at St. Petersburg, Fla.

Harding and Kemp Leave Holtzer-Cabot Company

Edwin R. Harding, president; William S. Kemp, treasurer, and Thomas W. Ness, formerly signal sales manager of the Holtzer-Cabot Electric Company, Boston, Mass., large minority stockholders in the company, have sold their holdings. Mr. Harding and Mr. Kemp have tendered their resignations, to be effective at an early date. Mr. Ness retired some months ago. Mr. Harding has been connected with the company 30 years. In 1898 he established the Western office of the Holtzer-Cabot Electric Company, with headquarters in Chicago, gradually developing a Western business of considerable proportions. For many years he was a director and first vice-president in charge of the Western states until he was called East in 1924 and made president.

Mr. Kemp entered the employ of the company in 1904 and a few months later became treasurer and director, handling all credits and financial matters and with supervision of all the accounting.

EDWARD DEAN ADAMS of New York City has been honored by the Belgian government in recognition of his work in connection with the restoration at Louvain. Upon him has been bestowed the decoration of Commander of the Order of King Leopold. Announcement of this honor was made at a banquet preceding the dedication of the library and carillon.

EDWARD CABOT, formerly manager of the Hudson Falls division of the New York Power & Light Corporation, has been appointed vice-president and general manager of the Quincy (Mass.) Electric Light & Power Company, recently acquired by the New England Power Association, Boston. S. C. Moore and not Frank D. Comerford, as lately announced in the daily press, is president of the Quincy company.

W. J. MYERS, who for the past six months has been receiver for the Robbins & Myers Company, Springfield, Ohio, was recently elected vice-president and general manager of Robbins & Myers, Inc., at a recent meeting of the board of directors.

JOHN K. SWANSON, for the past four years district manager of the Consumers Power Company at Saginaw, Mich., has been elected vice-president and general manager of the Minneapolis Gas Light Company. Since entering the utility field in Michigan in 1913, Mr. Swanson has been an active supporter of the work of the National Electric Light Association, in 1921 having been elected president of the state branch.

A. J. WAGER, for the last seven years in charge of power sales for the Milwaukee Electric Railway & Light Company, has left that company to engage in general consultant work on the development of industrial electric heating loads. Mr. Wager will remain in Milwaukee and from there will be available to utilities desiring to employ his services or advice in building up that type of load. He is eminently fitted for this kind of work, for it is very largely due to him that the Milwaukee utility holds its present place as one of the largest suppliers of electricity for industrial heating. Mr. Wager gave practically all of his attention to that phase of load development during the last five years. His previous utility experience, covering about fifteen years with the Edgar L. Potter interests and the Commonwealth Edison Company in Chicago, was entirely on load building work.

RAY W. PORTER, formerly manager of the Fulton (N. Y.) Light, Heat & Power Company, is now general manager of the Eastern Gas & Electric Securities Corporation with headquarters at Pine Orchard, Conn. The Warner interests control this company as well as the Fulton properties and the Rockville-Willimantic Lighting Company.

Porosky Heads Holtzer-Cabot Company

Matthew Porosky of Boston, Mass., was elected president of the Holtzer-Cabot Electric Company on Monday of this week, to succeed Edwin R. Harding, who has been president since 1924. Mr. Porosky has been with the company for about twenty years and has lately been its factory director. Frank A. Schirmer, of the Boston brokerage house of Schirmer, Atherton & Company, has been elected chairman of the board, and C. L. Kennedy, chief engineer of the company, has been made a member of the board, succeeding Thomas W. Ness, who retired several months ago. No action was taken on the treasurership, which becomes vacant in October through the resignation of William S. Kemp.

Obituary

RUSSELL R. ROSS, sales engineer of the Westinghouse Electric & Manufacturing Company in Denver, Colo., died June 25, after an illness of six weeks. Mr. Ross recently removed to Denver from Pittsburgh. He was graduated from the Westinghouse technical school in 1924.

ROBERT I. TODD, prominently identified with the public utility properties in Indianapolis, Ind., and a past-president of the American Electric Railway Association, died suddenly in New York July 13. Mr. Todd, who had come to New York to attend the meeting of the executive committee of the railway association, scheduled for July 14, was stricken with a heart attack on his return to his hotel after visting his sister. Though Mr. Todd devoted practically his entire professional career to the railway industry, he was identified with several light and power companies. Born at Lakewood, N. J., in 1869, he was educated in the public and private schools of New Jersey and Virginia and was graduated from the Johns Hopkins University with the degree of electrical engineer. At the time of his death he was president of the Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, and its subsidiary, the Terre Haute Traction & Light Company, Terre Haute, Ind., and was serving on the directorate of the Central Indiana Power Company, Indiana Electric Corporation, Northern Indiana Power Company and the Wabash Valley Electric Company. In addition to his active participation in the affairs of the American Electric Railway Association Mr. Todd was a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

CHARLES K. SUMMERHAYS, one of Rochester's pioneers in electric fixture retailing, died in Buffalo on July 9. Mr. Summerhays had been well known in business circles in western New York for a number of years. For more than twenty years he was connected with the Black & Boyd Company of New York City, specialists in gas and electric fixtures.

JOHN H. CUNTZ, consulting engineer, with offices in Hoboken, N. J., died May 29, in his sixty-second year. Mr. Cuntz was a graduate of Rensselaer Polytechnic Institute in civil engineering and of the Stevens Institute of Technology in mechanical and electrical engineering. In addition to his engineering work, he devoted considerable time to the study of political economy and he was also interested in exploration. Mr. Cuntz was an active member of the American Institute of Electrical Engineers.

FRED A. JONES, consulting and construction engineer of Dallas, Tex., died at his home in that city May 22. Mr. Jones was educated at Richmond College, Richmond, Va., and at Cornell University, Ithaca, N. Y. He spent some time in the testing department of the General Electric Company and also the railway engineering department early in his career. In 1906 he opened offices in Dallas, where he has since conducted a consulting engineering practice. Mr. Jones was a member of the American Institute of Electrical Engineers.

FRANK A. GAVAGAN, superintendent of distribution for the Consumers Power Company at Saginaw, Mich., died June 13 after a short illness. Though a native of Rochester, N. Y., Mr. Gavagan was a pioneer in the electrical industry in Saginaw, of which city he was a resident from early childhood. He took his first position in the electrical industry in 1886 as an employee of the Fort Wayne-Jenny Electric Company. Subsequent connections followed with the Saginaw Light & Power Company and the Bartlett Illuminating Company, and finally with the Consumers Power Company, as the result of numerous changes and consolidations.

Financial and Statistical News

Central Station Progress Continues

Energy Output for May is 6,712,571,000 Kw.-Hr.—Increase of 7.2 per Cent Over Last Year—Revenue $149,100,000

AN ENERGY output during May of 6,712,571,000 kw.-hr., or 7.2 per cent more than in the corresponding month last year; revenue of $149,100,000, involving virtually the same rate of gain, and operating expenses amounting to $65,400,000 are indicated as the national totals in the monthly reports on the activities of the electric light and power industry received by the ELECTRICAL WORLD.

These returns show a continuation of upward progress in the industry at about the same rate that prevailed earlier in the year and somewhat greater than in April.

The usual slight seasonal decrease in revenue is noted. The output, however, increased both for the month as a whole, which might be expected in view of the extra day, and in the daily average. The latter was 214,000,000 kw.-hr. in April and 216,000,000 kw.-hr. in May.

Checked against the five-year trend, the revenue has been slightly below the estimated normal since last December and continues so. The normal average daily revenue for May is computed to be $4,958,000; the actual average daily revenue was $4,820,000, or about 3 per cent short of the normal. Although the gain for the current year is somewhat lower than in the recent past, 1928 operations so far have materially exceeded those of 1927.

The energy output for the first five months overshot that of the corresponding period of 1927 by 7.1 per cent, suitable allowance having been made for the extra day in February. By way of comparison, the gain over the preceding year during the first half of 1926 was 13.1 per cent; during the first half of 1927 it was 11.3 per cent.

Unlike the revenue, operating expenses were higher in May than in April, due probably to the usual springtime activity to take care of the winter's accumulation of outside repair work.

The amount of energy generated in hydro plants was greater, both absolutely and relatively to the total, than ever before; the 3,063,634,000 kw.-hr. reported represents an increase of 16.7 per cent over May, 1927, and constituted 45.7 per cent of the total energy output.

While the energy generated in thermal plants was 1.5 per cent greater than a year ago, there was a decrease of 3.3 per cent in the consumption of coal, by far the most important fuel; a small increase in the use of fuel oil and an 18.1 per cent increase in the consumption of natural gas. Two-thirds of the last-named fuel is consumed in the four West South Central States.

Table I—Generation and Distribution of Central-Station Energy in the United States

(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated: Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.		Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
	1928 †Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Feb...	6,402,837	5,706,468	+12.2	5,272,837	4,696,468	1,395,000	1,210,000	3,367,837	2,928,468	510,000	477,000	1,130,000	1,010,000	1,221,000	1,034,000
March	6,767,622	6,314,272	+ 7.2	5,572,622	5,194,272	1,400,000	1,305,000	3,642,622	3,304,272	530,000	503,000	1,195,000	1,120,000	1,271,000	1,109,000
April..	6,425,031	6,049,656	+ 6.2	5,288,031	4,979,656	1,323,000	1,235,000	3,465,031	3,194,656	500,000	472,000	1,137,000	1,070,000	1,175,000	1,083,000
May..	6,712,571	6,218,471	+ 7.2	5,522,571	5,123,471	1,345,000	1,252,000	3,672,571	3,406,471	505,000	465,000	1,190,000	1,095,000	1,245,000	1,133,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

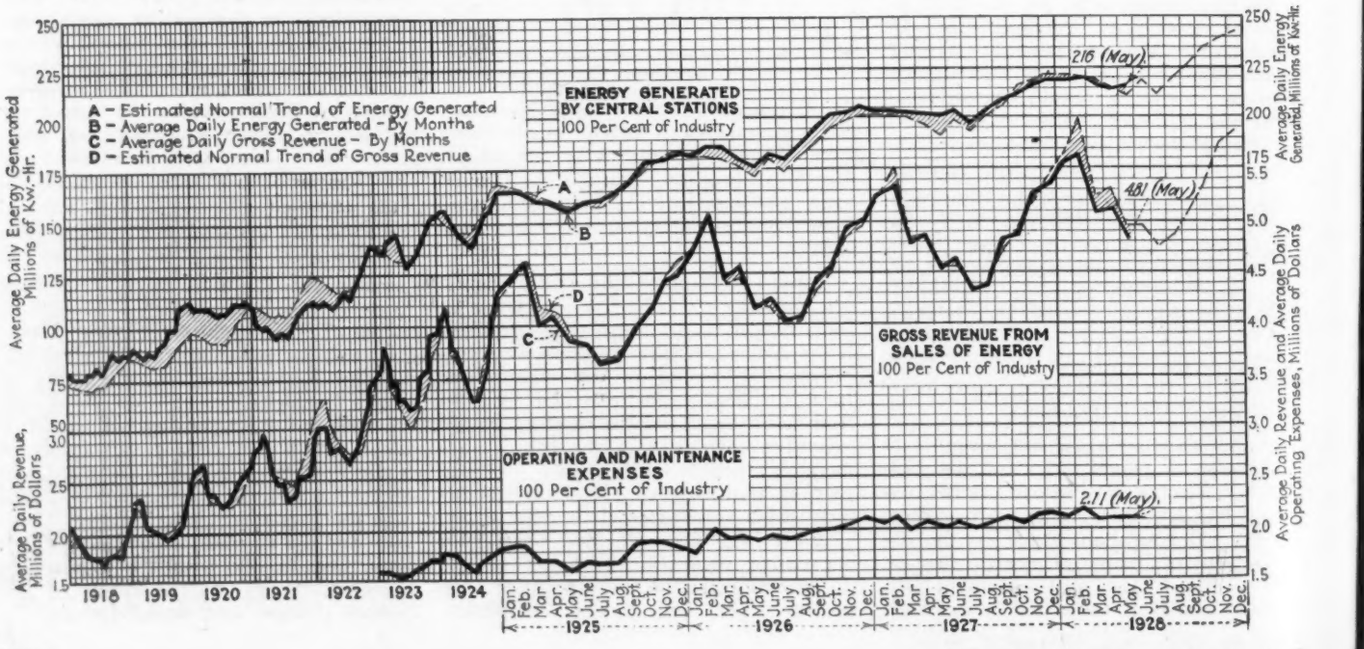

A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – By Months
C – Average Daily Gross Revenue – By Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALES OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
216 (May)
211 (May)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1918 1919 1920 1921 1922 1923 1924
1925 1926 1927 1928

Table II—Central-Station Financial Operations for Four Months in the United States

(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1928 Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Feb.....	$162,300	$151,100	+7.4	$94,100	$88,800	$51,500	$47,000	$5,600	$5,400	$11,100	$9,900	$64,200	$61,200
March...	157,300	145,200	+8.3	90,200	85,000	50,700	45,400	5,100	5,000	11,300	9,800	64,700	62,700
April....	153,400	144,800	+5.9	85,400	81,900	51,700	48,200	5,200	5,000	11,100	9,700	64,100	62,400
May.....	149,100	138,800	+7.3	82,900	77,400	50,900	47,800	4,950	4,700	10,350	9,900	65,400	62,700

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Short Tons	1927 Short Tons	Per Cent Increase	1928 Barrels	1927 Barrels	Per Cent Increase	1928 Thousands of Cubic Feet	1927 Thousands of Cubic Feet	Per Cent Increase
February..	2,462,450	2,172,740	+13.3	3,940,387	3,533,728	+11.5	3,122,160	2,958,797	+5.6	521,526	646,558	—19.4	4,896,497	3,859,791	+26.8
March.....	2,738,415	2,551,792	+ 7.3	4,029,207	3,762,480	+ 7.2	3,121,079	3,090,984	+1.0	584,545	612,657	—4.6	5,600,222	4,312,322	+29.8
April.....	2,831,359	2,526,938	+11.6	3,593,672	3,522,718	+ 2.0	2,806,458	2,942,421	—1.2	507,393	524,148	—3.2	5,304,215	4,482,900	+18.3
May.....	3,063,634	2,625,427	+16.7	3,648,937	3,593,044	+ 1.5	2,821,231	2,918,935	—3.3	468,102	462,386	+1.3	5,701,479	4,825,262	+18.1

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Regionally, the increase in revenue compared with May, 1927, was greater in the eastern and western seaboard states than in the central part of the country. This is brought out in the following table:

Region	Revenue — Per Cent Increase or Decrease Compared with May, 1927	April, 1928
New England.....	+ 7.4	—4.2
Atlantic.....	+ 7.2	—5.2
North Central.....	+ 6.0	—3.3
South Central.....	+ 2.6	—2.5
Western.....	+12.3	+7.5

Changes in energy output compared with last year, roughly indicative of the probable movement of June revenue figures, show 20 per cent or greater increase in the South Atlantic and West South Central States, 11 per cent in the Mountain and 9 per cent in the Pacific States. Little progress was shown in the Middle Atlantic States; the only section showing a decrease was the South Central, but in the latter it was due less to a reduction during the current year than to an exceptionally high output in May, 1927.

Southeastern Power & Light Increases Capital

Stockholders of the Southeastern Power & Light Company at their recent annual meeting approved an increase in the capitalization from 7,000,000 to 8,000,000 shares through the creation of a new issue of 1,000,000 shares of no par cumulative $5 preferred stock. The capitalization formerly included 5,000,000 shares of common, 750,000 shares of $7 cumulative preferred, 250,000 shares of $6 cumulative preferred and 1,000,000 shares of $4 cumulative participating preferred stock, all of no par value. The company is not planning to issue the new preferred stock immediately, having created it solely to provide means for future financing which would be more practicable than through the present $7 and $6 issues. There are outstanding 2,117,138 shares of common, 101,000 shares of $7 preferred, 20,945 shares of $6 preferred and 428,674 shares of $4 preferred stocks, in addition to 479,378 option warrants, each giving the right to purchase one share of common stock at $50.

Consolidated Gas-Brooklyn Edison Merger Ratified by Shareholders

AT A special meeting held this week shareholders of the Consolidated Gas Company of New York ratified the proposed merger with the Brooklyn Edison Company and voted to increase the authorized common stock from 4,320,000 shares to 12,000,000 shares. It was also decided to split the existing common stock on a two-for-one basis. Brooklyn Edison stock will be acquired through exchange of securities, Edison shareholders receiving for each share of their stock two of the split shares and one $5 preferred share of Consolidated Gas.

Following the merger, the capitalization of the Consolidated Gas Company will consist of 12,000,000 shares of no-par common stock and 3,000,000 shares preferred stock, of which 10,440,000 shares of common and 2,100,000 shares of preferred will be outstanding if all of the Brooklyn Edison stock is exchanged. There are 900,000 shares of $100 par Brooklyn Edison stock issued of an authorized issue of 1,000,000 shares.

Funded debts of the combined companies figured as at the close of 1927 total $241,095,790, and the minority stockholdings in affiliated companies are $964,421.

A meeting of the Public Service Commission was held this week on the petition of the Consolidated Gas Company to issue 1,800,000 shares of new no-par common stock and 900,000 shares of $5 cumulative preferred stock and to acquire all of the outstanding capital stock of the Brooklyn Edison Company. The hearing was adjourned to next week.

While Consolidated Gas officials have not yet made public information with regard to who are to be the officers of the new company and what plans of operation will be followed, it is rumored that the two companies will be operated separately, for the present at least.

Will Result in Substantial Saving

During the hearing before the Public Service Commission M. S. Sloan, president of the Brooklyn Edison Company, testified concerning the advantages which would accrue to the public from the merger. He stated that the Brooklyn power plants were in a better position to serve the lower part of Manhattan with current than the New York Edison Company. He pointed out that single operation of the two companies would save duplication of capital necessary for increasing plant capacity. Asked about the probable magnitude of the saving, Mr. Sloan admitted that a saving of several million dollars was a possibility, adding that the Brooklyn Edison Company had always been willing to share savings in operation with the public.

The brief which will be filed with the Public Service Commission by the city will ask approval of the merger and not to include validation of any of the franchises of the Brooklyn company.

Commonwealth Power to Increase Stock

At the annual meeting to be held Aug. 7 stockholders of the Commonwealth Power Corporation will be asked to ratify an increase in the authorized preferred stock of the company, consisting of 500,000 shares of $100 par stock, through the addition of 500,000 shares of no par value. The new stock is to rank equally with the present preferred issue and may be issued from time to time in one or more series. The dividend rates, callable prices, conversion privileges and sinking fund provisions for any series of new preferred stock are to be determined by the stockholders or by amendments to the by-laws. The stockholders will also be asked to authorize the directors to adopt and amend the by-laws from time to time.

FEATHER RIVER COMPANY ELECTS NEW OFFICERS AND DIRECTORS.—Following the election of a new board of directors as a result of the control of the Feather River Power Company passing into the hands of the Western Power Corporation, Guy C. Earl has been elected president of the Feather River company and A. Emory Wishon has been named vice-president and general manager. Directors include Messrs. Earl Wishon, W. H. Spaulding, secretary; C. Haffee Hall, assistant secretary, and R. A. Sharon.

ITALIAN COMPANY PAYS INITIAL DIVIDEND. — The Italian Superpower Corporation has declared an initial quarterly dividend of $1.50 on its preferred stock.

NIAGARA FALLS POWER RETIRES PREFERRED STOCK.—Seven per cent preferred stock (par $25) of the Niagara Falls Power Company was stricken from the list of the New York Stock Exchange on June 30. A majority of this issue (outstanding on Dec. 31 to the amount of $17,018,100) was exchanged for $5 cumulative first preferred stock, no par value, of the Buffalo, Niagara & Eastern Power Corporation. The balance was retired on June 30 at 27½ and dividends.

Allis-Chalmers Declares Larger Dividend

The directors of the Allis-Chalmers Manufacturing Company on July 13 declared a quarterly dividend of $1.75 per share on the outstanding $26,000,000 capital stock, par $100, payable Aug. 15 to holders of record July 24. The extra disbursement to the common-stock holders is indicative of the consistently improving financial status of this electrical manufacturing company. The initial dividend on the common stock was paid Aug. 15, 1920, and amounted to 1 per cent. This quarterly rate was maintained to Feb. 16, 1925, when $1.50 was paid, the rate which has been paid since that time. The earnings per share on the common has advanced steadily from $3.12 in 1921 to $10.02 per share in 1927. The market record of the stock is shown in the accompanying table.

	1924	1925	1926	1927	1928
High	73½	97½	94⅜	118¾	129¾
Low	41⅜	71½	78¼	88	115⅜

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 17	Low 1928	High 1928
ABITIBI PWR. & PAPER, com. new—no par	59½	57	85
Ala. Pwr., $7 cum. pf.—no par	*m* 114	114½	115½
Allis Chalmers Mfg., 6% com	*m* 127½	115⅛	129¾
Aluminum Co. of Amer., com	*m* 147	120	197½
Aluminum Co. of Amer., 6% pf	*m* 108½	105½	110½
Amer. & Foreign Pwr. 7% pf.—no par	*m* 106½	104¾	110
Amer. & Foreign Pwr., com.—no par	33⅛	22⅛	38⅞
Amer. Bosch Magneto, com.—no par	32	15⅜	41
Amer. Brown Boveri Elec.	15⅛	10⅜	26⅛
Amer. Brown Boveri Elec., pf. $7	*m* 56⅛	40⅛	65⅜
Amer. Gas & Elec., 6% pf.—no par	*m* 106	104¼	111
Amer. Gas & Elec., com.†—no par	155½	117½	184
Amer. Lt. & Trac., 6% pf	118	116	120
Amer. Lt. & Trac., new com	*m* 220	170	249
Amer. Pwr. & Lt., 6% pf	*m* 103	102	109
Amer. Pwr. & Lt., com.†—no par	77⅛	62½	95
Amer. Pub. Serv., 7% pf	*a* 101	97½	104
Amer. Pub. Serv., com.†	*m* 60	...	...
Amer. Public Utilities, 7% ptc. pf	*a* 95	93¾	97½
Amer. Public Utilities, 7% pr. pf	97½	90	103¼
Amer. Public Utilities, com.	*m* 50	...	...
Amer. States Sec., A	10¼	7½	14
Amer. States Sec., B	*e* 15	7½	18½
Amer. Superpower, 6% 1st pf	*l* 98½	...	...
Amer. Superpower, Class A†—no par	*m* 36⅛	33¾	56
Amer. Superpower, Class B†—no par	*m* 36⅛	35⅛	56⅛
Amer. Wtr. Wks. & Elec., 6% pf	100½	100	106
Amer. W. W. & E., com. new—no par	55	52	70⅜
Anaconda Copper cap. $3	65½	53⅜	74⅜
Appalachian Electric Pwr., 7% pf	109	107	110
Arkansas Pwr. & Lt., 7% pf	106	108	109½
Assoc. Gas & Elec., $3.50—50	51⅜	...	...
Assoc. Gas & Elec., pf.—$6—no par	96⅜	96	98¼
Assoc. G. & E., Class A, 10—no par	48¼	47	52⅜
BABCOCK & WILCOX, 7% com	121	117½	128
Binghamton L., H. & P., $6 pf	101	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf	*m* 105	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m* 165	135	170
Blaw-Knox com.†	*i* 103	91	108
Brazilian Trac., Lt. & Pwr., com., new	*f* 56⅛	...	...
Broad River Pwr., 7% pf	102½	105	108½
Brooklyn Edison, 8% com	*m* 240	206½	268½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*i* 26⅛	...	...
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*i* 39¼	...	...
CALIFORNIA ELEC. GENERATING, 6% pf	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par	*l* 109	109	111
Central & S. W. Util., $7 pf.—no par	*a* 101½	99¼	105½
Central & S. W. Util., pr. in. $7 pf.—no par	*a* 105	103½	112
Central Ark. Ry. & Lt., 7% pf	105	105	107½
Central Ill. Pub. Serv., $6 pf	*a* 97½	97½	100½
Central Ind. Pwr., 7% pf	*a* 97	95	101
Central Maine Power, 6% pf	97	96	98½
Central Maine Power, 7% pf	110	109	112
Central Pwr. & Lt., 7% pf	106	104½	114
Central States Elec., 7% pf	113	104	118
Cincinnati Gas & Elec., 5% com	*g* 100	97½	100½
Cities Service, $6 pf.—no par	*i* 100	94½	103½
Cities Service, pf. B—no par	*l* 9½	8⅜	9⅜
Cities Service, pf. BB—no par	*l* 95	88½	97
Cities Service, com.—20	*l* 66½	54	71⅛
Cities Service, Bks. Shrs.—10	*l* 32½	26⅜	35⅛
Cities Service Pwr. & Lt., 7% pf	*m* 106	106	109½
Cities Service Pwr. & Lt., 6% pf	99½	95½	102
Cleveland Elec. Illg., 6% pf	109	105	115½
Cleveland Elec. Illg., 10% com	425	350	425
Columbia Gas & Elec., 6% pf	108½	106	110½
Columbia G. & E. com. $5—no par	107	89½	118⅜
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 7%	104	107	111
Columbus Ry., Pwr. & Lt., 7% pf. B	103	105	111
Columbus Ry., P. & Lt., com. no par	125	120	125
Commonwealth Edison, 8% com	*a* 183	165	189
Commonwealth Pwr., 6% pf	100	100	104⅞
Commonw'th Pwr., $2, com.—no par	73	62½	87⅞
Conn. Lt. & Pwr., 8% pf	118	120	123
Conn. Lt. & Pwr., 7% pf	115	118	121
Cons. Gas of N. Y., pf	101	100½	105
Cons. Gas of N. Y., com. $5—no par	145½	119¼	170½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf	*e* 110½	109½	114½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf	*e* 102½	100	105⅛
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par	*e* 79	67½	93
Consolidated Power & Lt., 7% pf	*m* 105	106	109
Consumers Power, 6% pf	103½	105½	106½
Consumers Power, 6.6% pf	104	106	107
Continental Gas & Elec., 7% pr. pf	105½	105½	108½
Contl. G. & E. com. $4.40—no par	*m* 225	240	265
Crocker Wheeler, com.†	80	23	85
Crocker Wheeler, 7% pf	97	77	98
DALLAS PWR. & LT., 7% pf	110	110	111½
Dayton Pwr. & Lt., 6% pf	107½	107	110½
Derby Gas & Elec., 7% pf	100	96	100½
Detroit Edison, 8% com	*m* 199	166½	209½
Dubilier Condenser, com.—no par	*m* 3⅛	2⅛	5⅛
Duke Pwr., cap	*m* 135	130	145
Duquesne Lt., 5% pf	*m* 101	100½	116½
EASTERN NEW YORK UTIL., $7 pf	*m* 110	111	112½
Eastern States Pwr. B	*m* 18	12	24
Eastern States Pwr., pf	*m* 100½	98	100½
East. Tex. Elec., 7% pf	105	106	109
Edison Elec. of Boston, $12 com	*d* 282	252	305
El Paso Elec. 7% pf	*m* 115	110	112½
Elec. Bond & Share, 6% pf	*l* 108	108¼	111½
Elec. Bd. & Sh. Sec., com. $1—no par	*m* 99½	76	127½
Electric Household Util.†	*a* 23	13½	27
Elec. Investors, 6% pf.—no par	101½	101	104½
Elec. Investors, com.†—no par	59½	40½	79½
Elec. Pwr. & Lt., ctfs. pf	107½	106½	110½
Elec. Pwr. & Lt., ctfs., com.—no par	34	28¼	45½
Elec. Ry. Securities, com.—no par	6¼	...	...
Elec. St. Battery com. $5.25—no par	76	69	84½
Elmira Wtr., Lt. & R.R., 7% pf	105	104	115
Empire Pwr., ptc.†	*m* 33	27½	39½
Engr. Pub. Serv. $5, pf.—no par	*m* 97½	97	102
Engr. Pub. Serv., com.—no par	37	33	46½
Eureka Vacuum Cleaner, com. $4—no par	62	60½	79
FAIRBANKS MORSE, 7% pf	*m* 106½	104	114
F.-M., com.—$3—no par	41½	32½	54
Federal Lt. & Trac., com. $1.40	*m* 52	42	56½
Federal Lt. & Trac., $6 pf.—no par	*m* 107½	98	109
Florida Pwr. & Lt., 7% pf	*m* 102	105	108
Ft. Worth Pwr. & Lt., 7% pf. ex div.	*l* 112	113	114½
GALVESTON-HOUSTON ELEC. 6% pf	80	75	85
Galveston-Houston Elec., com	33	31	34
General Cable, Cl. A	63	56	84½
Gen. Elec. $3 com.—no par	145½	124	174½
Gen. Elec., special—6%	11⅛	11⅛	11⅛
Gen. Gas & Elec. (Del.), com. A $1.50 no par	51	35½	51½
Gen. G. & E. (Del.) pf. A. $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	114	104	117
Gen. Pub. Serv., $7 pf	98	115	140
Gen. Pub. Serv., com., no par	23⅜	16⅛	29
General Public Utilities, $7 pf	*m* 97	98	103
Ga. Lt., Pwr. & Rys., com	*m* 58	55	65
Gt. Western Pwr., 70% pf	*h* 105	...	...
IDAHO PWR., 7% pf	109	109	111½
Ill. No. Utilities, 6% pf	*a* 100	96	100
Ill. Pwr. & Lt., $6 pf	106½	103	107
Indianapolis Pwr. & Lt., 6½% pf	*m* 104	102	107½
Indianapolis Pwr. & Lt., $7 pf	101	100	105
Ingersoll Rand com	*m* 90½	90	98
Int. Combus. Engr., com. $2—no par	58½	45½	72⅜
Int. Combustion Engr., 7% pf	*m* 101	103	109
Int. Util., Class A—$3.50—no par	*m* 16	44½	52
Int. Utilities, Class B—no par	16½	6¼	19½
Interstate Pwr., pf.—$7—no par	99	99	105
Interstate Pub. Serv., 7% pf	106	103	108
Iowa Ry. & Lt., 7% pf	*m* 101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf	103½	106	108
Johns-Manville, com. — no par	108¼	96½	134

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, July 18. *m*Bid price Saturday, July 14. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 17	Low 1928	High 1928
KANSAS CITY POWER & LIGHT			
pf. $7	*m*108¼	108¼	114
Kansas Gas & Elec. 7% pf.	*l*108½	107	110
Kelvinator Corp.	16	11¼	22¾
Kentucky Hydro-Elec., 7% pf.	*a*102½	102	104½
Kentucky Sec., 6% pf.	90	90	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	*m*220	200	260
Long Island Ltg., 7% pf	109½	109	112½
Long Island Ltg., 6% pf.	*m*103	107	109
Long Island Ltg., com.†—no par	*m*250	170	250
Los Angeles Gas & Elec., 6% pf.	*h*108½	105½	112½
Louisville Gas & Elec., cl. A. $1.75	34	28	41
MAN. ELEC. SUPPLY, cap. $5—no par	60½	50	66½
Maytag Co., com. 50—no par	*m* 19½	18½	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	104½	103	109½
Metropolitan Ed., pf.—$7—no par	108½	109	111½
Metropolitan Ed., com. $5—no par	*m*160	125	185
Middle West Utilities, 6% cum. pf.	*a* 96½	93½	100½
Middle West Util., cum. pr lien	*a*102	99	108
Middle West Util., com. $7—no par	*a*143½	123½	169
Midland Utilities, pr. ln. 7% pf.	*a*103	99½	107
Midland Utilities, 6% pf. A	*a* 90	89½	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*107	107	109
Miss. River Pwr., 6% pf.	108	94	112½
Mohawk Hudson Pwr., 1st pf.—$7—no par	*m*1⁰8	107½	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	*m*102	102½	108½
Mohawk Hudson Pwr. com.—no par	*m* 39½	29½	53
Montana Pwr., 5% com.	*m*147	102½	175
Montreal Pwr., com. $2—no par	*f*106	....	....
Mountain States Pwr., 7% pf.	*m*102	97	105
Mountain States Pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110½
National Carbon, 8% pf.	*n*138	136½	139½
National Elec. Pwr., A†	*a* 33½	27½	42
National Pwr. & Lt., pf. 7%	109	107	111
National Pwr. & Lt., com.†—no par	32½	21½	36½
National Pub. Serv., 7% pf.	99	99	104
National Pub. Serv., A com. $1.60—no par	25½	22	29½
National Pub. Serv., B com.—no par	*n* 30	24½	32½
Nebraska Pwr., 7% pf.	*l*108½	110	111½
Nevada-Calif. Elec., com.	*m* 53	33½	53
New Brunswick Pwr., 4% pf.	*m* 60	69	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98½	110½
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	105	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	*m*100	101	107
New York Power & Light 7% pf.	112	....	....
No. Amer., 6% pf.—50	54½	53½	55½
No. Amer., com.—10	68½	58½	78½
No. Amer. Edison, $6 pf.—no par	101½	100½	105½
Northeastern Pwr., com.	25½	19½	31
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	*m* 28½	18	32
Northern Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt. & Pr. 6% pf.	*m* 98	94	100
No. States Pwr. (Del.), 7% pf.	109	108½	110½
No. States Pwr. (Del.), 8% com.	134½	123	152
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	19	....	....
OHIO BRASS, com. B $4—no par.	*k* 90½	90	100½
Ohio Brass, 6% pf.	*k*105	105	108½
Ohio Pwr., 6% pf.	108	104	109½
Ohio Pub. Serv., $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	111½	107	112
Ohio River Edison, 7% pf.	107½	106	109½
Oklahoma Gas & Elec., 7% pf.	110½	106	115½
PACIFIC GAS & ELEC., 6% pf.	*sa* 26	25½	29
Pacific Gas & Elec., 8% new com.	47½	43½	53½
Pacific Pwr. & Lt., 7% pf.	*l*109	106	110
Packard Electric	*k* 65½	47	68½
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 79	78½	82
Penn-Ohio Edison, 6% pf. no par	*m* 95	78	99
Penn-Ohio Edison, 7% pf.	105½	97½	109
Penn-Ohio Pwr. & Lt., 7% pf.	109	....	....
Penn Pwr. & Lt.—$7—no par	*l*108½	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 77½	68	80
Phila. Co., 5% pf.—50	47	45½	48½
Phila. Co., 6% pf.—50	52½	52	57
Phila. Co., com.—50	*m*150½	145	174½
Phila. Elec., 8% com.—25	*c* 66	55½	74¼
Portland Elec. Pwr., 7% pf.	103	100	106
Portland Elec. Pwr., 6% pf.	93	78	96
Portland Elec. Pwr., 6% 2d pf.	*n* 83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*j*111½	....	....
Pwr. Sec., pf.—no par	*m* 58	50	68
Pwr. Sec., com.—no par	*n* 13½	11½	14½
Public Serv. of Colorado, 7% pf.	107	....	....
Pub. Serv. of N. J., 6% pf.	*m*107	103½	115
Pub. Serv. of N. J., 7% pf.	126	118	129½
Pub. Serv. of N. J., $2 com.—no par	53½	41½	66½
Pub. Serv. of No. Ill., 6% pf.	*a*117	....	....
P. S. of No. Ill., com. $8—no par	*a*187	159½	190½
Pub. Serv. of No. Ill., $8 com.	*a*186	139½	190
Pub. Serv. of Okla., 7% pf. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	108½	107½	110½
Puget Sound Pwr. & Lt., 7% pf.	*m*110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	*m*100	96½	105½
Puget Sound Pwr. & Lt., com.	*m* 57	34½	94½
RADIO CORP. OF AMER., $3.50 pf.—50	*m* 56	54½	60
Radio Corp. of Amer., com.—no par.	165½	85½	224
Rochester Gas & Elec. 6% pf. D	105½	105½	106½
Rochester Gas & Elec., 7% pf. B	107	105	108
Rochester Gas & Elec., 6% pf. C	104	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	117	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*m* 75	70	75
Servel, Inc.	*m* 13½	4½	17½
Shawinigan Water & Power.com..$2 no par	*f* 92	....	....
Sierra Pacific Elec., 2% com.	*m* 49½	29	49½
Sioux City Gas & Elec., 7% pf.	104½	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*105½	....	....
Southeastern Pwr. & Lt., pfc. pf.	*l* 87	....	....
Southeastern Pwr. & Lt., com.—no par	49	40½	61
So. Calif. Edison, 8% pf.	49	38½	53
So. Calif. Edison, 7% pf.	29	27½	29½
So. Calif. Edison, 6% pf.	27	25½	27½
So. Calif. Edison, 8% com.	46½	43½	53½
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3.	65	60	80
Southwestern Lt. & Pwr., B	50	....	....
Southwestern Lt. & Pwr., $6 pf.	93	88	96½
Southwestern Pwr. & Lt., 7% pf.	*m*110	103	115
Standard Gas & Elec., 8% pf.	66½	65	71½
Standard Gas & Elec., 7% pr. pf.	111	108	115
Standard G. & E., com. $3.50	64½	57½	74½
Standard Power & Light, com.	*m* 46½	29½	58½
Standard Pwr. & Lt., 7% pf. ex. div.	*m*105	103½	107½
Staten Island Edison, pf.—$6—no par	98	99	103½
Superheater, $6 com.—no par	148	149½	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*m*120	114	121
TAMPA ELEC., com. $2	*m* 65½	62	71
Tenn. Elec. Pwr., 6% pf.	99	92	103
Tenn. Elec. Pwr., 7% pf.	107	107	110
Tex. Pwr. & Lt., 7% pf. ex. div.	*l*112	113½	115
Tide Water Pwr., 8% pf.	107	108	112
Timken Roller Bear., com.—$4 no par	119	112½	134
Toledo Edison, 7% pf.	109	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*m*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*132½	114½	149½
United Lt. & Pwr., pf.—$4—no par	*m* 55	49	56½
United Lt. & Pwr., pf.—$6.50—no par	*a* 99	95	102½
United L. & P., com. A .48—no par	*a* 25½	13½	27½
United L. & P., com. B .48—no par	*a* 33	20½	33
Utah Pwr. & Lt., 7% pf.	*l*107	109½	112
Utica Gas & Elec., 7% pf.	106	105	107
Utica Gas & Elec., 8% com.	*m*200	215	225
Utilities Pwr. & Lt., 7% pf.	99	98	104
Utilities Pwr. & Lt., com. A $2	37½	28½	45½
Utilities Pwr. & Lt., com. B $1—no par	*m* 29	18½	32½
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	*m*108	108	111
Virginia Public Service 7% pf.	104	97	103½
WAGNER ELEC., 7% pf.	*n*104	96½	107
Wagner Elec., com.—no par	*b* 82½	37	120
Washington Ry. & Elec., 7% com	*f* 450	....	....
Washington Ry. & Elec., 5% pf.	*f* 99½	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 6% pf.	102½	100	104½
West Penn Elec., Cl. A $7	107	103	112
West Penn Pwr., 7% pf.	*m*116	114	118
West Penn Pwr., 6% pf.	107½	103	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	*m*104	100	106
Westinghouse Elec. & Mfg., 8% com.—50	90½	88½	112
Weston Elec. Instrument, Cl. A $2—no par	*m* 33	30½	40½
Weston Elec. Instrument, com.—no par	22½	12½	28½
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A	*m* 49½	46½	58½
Worthington Pump, 6% B	*m* 42	41	51
Worthington Pump, com.	*m*30½	28	37½
YALE & TOWNE com. $5—25,	*m* 68½	68½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, July 18. *m*Bid price Saturday, July 14. *n*Latest quotations available. †Dividend rate variable.

BRAZILIAN TRACTION PAYS DIVIDEND ON NEW STOCK.—The Brazilian Traction, Light & Power Company, Ltd., declared an initial dividend of 44 cents on the new no-par common stock, payable Sept. 1 to holders of record July 31. This is equivalent approximately to 7 per cent on the old $100 par common. This dividend does not apply to new stock recently subscribed for, the new stock not being entitled to a dividend until Dec. 1.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of not exceeding $65,190 common stock of the Federal Light & Traction Company (par $15) on official notice of issuance as a stock dividend, making the total amount applied for $6,585,155 common stock. There have also been authorized for listing on the New York Exchange 118,301 additional shares of common stock without par value of the North American Company, on official notice of issuance as a stock dividend payable on July 2, with authority to add 28,850 shares in exchange for common stock of the Western Power Corporation, making the total number of shares applied for to date 4,890,012 shares without par value.

ALLIED POWER & LIGHT DECLARES INITIAL DIVIDENDS.—The board of directors of the Allied Power & Light Corporation has declared initial quarterly dividends of $1.25 per share on the 5 per cent cumulative first preferred stock and 75 cents per share on the 3 per cent cumulative preference stock, respectively, both payable Aug. 15, 1928, to stockholders of record July 27, 1928.

CENTRAL WEST PUBLIC SERVICE OFFERS ADDITIONAL ISSUE.—An additional issue of first lien collateral 5½ per cent gold bonds has been offered by the Central West Public Service Company to the amount of $2,050,000 (series A $650,000 and series B $1,400,000) at 98 and accrued interest, to yield about 5.65 per cent.

CENTRAL PUBLIC SERVICE RECLASSIFIES STOCK.—Stockholders of the Central Public Service Corporation, Chicago, have approved amendments which vest full powers of participation in the future growth and earnings of the properties of the corporation in its class A stock. It is said the reclassification of the class A stock is only the first step toward a readjustment of the capital structure of the corporation in order to

facilitate the financing of properties for growth. Heretofore the class A stock has been limited to $2.50 a share annual dividends and $25 a share in the event of liquidation. As a result of the amendment, it had priority over the common stock to the extent of $1.75 a share yearly in dividends and $30 a share in liquidation, and will participate equally with the common stock when that stock has received a sum equivalent to the priorities of the class A stock.

Massachusetts Utilities Investment Trust Shows Rapid Progress

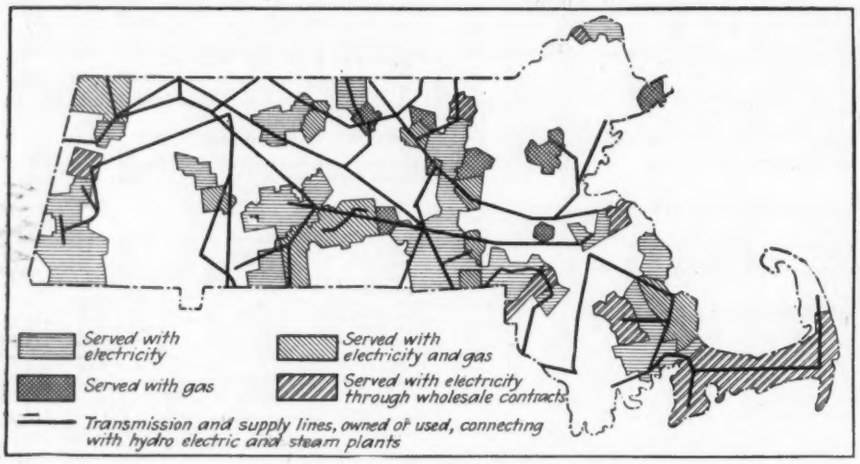
FORMED to acquire the securities of a group of electric light, power and gas companies within Massachusetts, the Massachusetts Utilities Investment Trust is a more or less unique organization within the utility field. Since it holds from 62 to 100 per cent control of the companies under its jurisdiction, it is rather a holding company than an investment trust as the term has come to be used. At the present time there are 49 companies in the group, serving directly and indirectly 94 cities in the state. Other assets of the trust include 1,000 shares of Boston Edison stock and 1,000 preferred shares of the New England Power Association.

The companies whose properties are included under the Massachusetts Utilities Investment Trust are retailers of electricity and gas for light, heat and power in the territories covered. While the properties include several small water powers, the companies are, in the main, purchasers of power at wholesale from one or the other of the large producing systems. Territories served are so situated that in each case power may be purchased from at least two different producing companies, which, with the added feature of the possibility of building modern steam plants of their own, place the retailing companies in an advantageous competitive position for the purchase of power.

The business of the companies in the group shows a steady growth both in total sales and in earning power per dollar of investment. That this will continue is forecast by the fact that more business is being added to lines already existing in territory which is increasing in population. Gross income of the companies included has increased from $721,800 in 1906 to $9,851,726 in 1927.

An outstanding feature of the group is the wide diversity of power users. Exclusive of electric lighting customers, numbering over 100,000, there are over 3,500 individuals, municipalities and corporations using nearly 100,000 of connected horsepower. The accompanying rather unique analysis of its customers has been made.

The capitalization of the company includes 422,324 convertible participating 5 per cent preferred shares out of a total of 700,000 authorized and 1,157,976 voting trust common shares of no par value out of a total authorized of 2,500,000. There are no bonds or other debt. The common shares are deposited under a voting trust agreement whereby they may not be sold except as a whole and for not less than a specified price.


Served with electricity
Served with electricity and gas
Served with gas
Served with electricity through wholesale contracts
Transmission and supply lines, owned or used, connecting with hydro electric and steam plants

Service map of Massachusetts Utilities Investment Trust

No. Group		Present Connected Hp.
Manufacturing		
3	Baby carriage plants	565
68	Bakeries	321
190	Blower and fan plants	289
1	Brake lining plant	900
6	Brick makers	341
7	Brush and broom plants	584
112	Candy, ice cream, beverages	1,590
1	Casket maker	208
33	Celluloid plants	3,650
7	Cutlery makers	940
16	Metal-working plants	1,444
1	Fiber board plant	800
20	Foundries	1,702
11	Hat makers	912
6	Jewelry plants	411
12	Leather plants	288
103	Machine shops	4,318
10	Wire makers	2,542
21	Paper mills	3,270
8	Piano case makers	435
83	Shoe plants	5,363
2	Steel plants	234
4	Tanneries	559
6	Tool makers	2,300
6	Toy makers	689
53	Woodworking shops	1,219
Public Institutions		
46	Churches	108
29	Fire alarm systems	290
31	Hospitals	699
33	Hotels	276
3	Railroads	1,765
60	Schools, colleges, libraries and other institutions	795
48	Water and sewer departments	1,074

No. Group		Present Connected Hp.
Agriculture		
28	Cranberry bogs	1,258
9	Canning and cider plants	89
56	Dairy plants	539
486	Farms, pumps, etc	2,764
29	Lumber and saw mills	1,936
117	Meat markets	467
63	Milk dealers	210
2	Rendering plants	112
77	Sand, gravel, quarries	3,680
9	Lime plants	2,025
Textiles		
2	Bleacheries	336
16	Cotton mills	2,145
3	Hosiery mills	481
3	Loom plants	245
5	Rug makers	409
2	Shirt factories	234
9	Silk mills	579
8	Spindle plants	151
34	General textile	10,280
21	Woolen mills	5,367
6	Wool scouring plants	398
General		
34	Carpenters	371
119	Coal, ice and grist plants	1,665
22	Contractors	229
206	Domestic power users	389
52	Grain elevators	735
300	Garages	3,823
55	Laundries	534
64	Printing plants	2,553
35	Theaters	1,063
65	Stores and banks	141
43	Refrigerator plants	228

British Electricity Consumption Nearly Doubled

It is announced by the British Electricity Commission that the latest figures available to the commissioners show that the amount of electricity sold to consumers by authorized undertakers in Great Britain in the year 1927 was 6,850,000,000 units.

The sales of electricity to consumers in 1927 represented an increase of about 19.6 per cent on the figure for the previous year. Since 1920-21 the annual sales of electricity by the authorized undertakers have increased from about 3,512,000,000 units to 6,850,000,000 units; i.e., by 95 per cent. The sales thus have practically doubled in the course of seven years, notwithstanding the fluctuating conditions of trade and industry during that period.

COPELAND PRODUCTS REPORTS INCREASED EARNINGS IN MAY. — May earnings of Copeland Products, Inc., Detroit, manufacturer of refrigeration machines, amounted to $75,728 after deductions for interest, depreciation and taxes and reserves, according to a statement by E. H. Brown, vice-president and treasurer. This does not take into consideration the operations of subsidiary companies. May earnings showed an increase of $9,391 over those for April, making total net profit for the first five months of 1928 $182,135, equivalent to $1.79 per share for the "A" stock. May shipments showed a 60 per cent increase over May of 1927. June shipments were practically 80 per cent greater than for the same month one year ago and marked the tenth consecutive month to show an increase over the like period of the year previous.

Business News and Market Conditions

Industrial Truck Companies Undertake Market Survey

Manufacturers of electric industrial trucks who are members of the Society for Electrical Development, Inc., in furthering their co-operative market development work have engaged the firm of R. O. Eastman, Inc., New York, to undertake immediately a co-operative market research survey of the equipment they make. This survey will embrace all phases of the marketing, advertising and selling of industrial trucks. It is estimated by officials of the Eastman company that the work will be completed late in the fall.

Flotation Principle Adds to Michigan Copper Recovery

Application of the principle of flotation in the treatment of amygdaloid ores in the Michigan copper district promises to add materially to the recovery of copper there, according to an announcement at the Bureau of Mines. Since January active experimentation has been carried on under a co-operative agreement by the mine operators, the Michigan College of Mines and Technology and the Bureau of Mines. All of those concerned are agreed that a very important discovery has been made.

Metallic copper of the amygdaloid ores had been thought to be too coarse to float. Earlier attempts at flotation gave negative results. Under the direction of A. W. Fehrenwald, an ore-dressing engineer on the staff of the Bureau of Mines, a method of flotation has been worked out which adds greatly to the recovery of copper from the amygdaloid ores. In addition to the increased recovery, there is a saving of smelting, costs of concentrate, there is a lower slag loss and there is no table middling to regrind. As a result of the very successful experiments which have been conducted in recent weeks the entire district is planning to undertake the flotation of amygdaloid copper on a commercial scale.

N.E.C.A. Meets in Boston

The annual convention of the National Electric Credit Association was held July 16 and 17 at the Statler Hotel, Boston. An attractive program included among the speakers Elliot S. Boardman, manager Industrial Statistics Division, Federal Reserve Bank, Boston, who put before the meeting the responsibility resting on credit men for keeping in touch with the business conditions of the country. As reliable sources of information available to all were noted the various progress reports of trade journals, the indexes of trends issued by technical publications, the statistical charts of banking organizations and numerous government periodicals. These sources are indispensable aids, without which no credit man can survey conditions and preserve a broad understanding of the problem of production and consumption.

In the opinion of Frank E. Watts, vice-president Bennett-Watts-Haywood Company, Chicago, the credit man is both counselor and adviser for distributor and consumer. Manufacturers are contending with higher costs and strong competition. There are 500 wholesale and 11,000 retail hardware jobbers pitted against electrical dealers, he told his audience.

Officers elected for the current year are: Benjamin P. George, Beardsley Chandelier Company, Chicago, president; J. A. Lecour, Mitchell-Rand Company, New York, vice-president; Frederick P. Vose, Chicago, secretary-treasurer.

Industrial Building Maintains Lead Over 1927

New industrial building construction—physical plant expansion—is an excellent index of business confidence. Companies do not authorize new factories, power plants or extensions to existing plants unless they believe they can use them in added production. Comparison of the value and number of new contracts awarded for construction in 28 industries, as compiled by the *Engineering News-Record*, is given in the accompanying table.

Contracts for industrial building construction in the first five months of this year total $124,693,000, compared with $97,947,000 in the same period of 1927. There were 599 of these contracts, compared with 575 last year. The average value of the 1928 job is $208,158, against $170,342 in 1927. The accompanying table breaks down these figures into 28 classes or industries. The public utilities group is the leader with 53 jobs valued at $23,000,000, which is almost the exact figure for 1927.

It is seen that the expansion of plants has been quite general, with large increases in the following lines: Paper and pulp, heavy chemicals, manufactured gas, rayon, glass, automotive and refrigeration. All sections of the country, except the Far West, shared in this increased activity in industrial building. Very substantial gains were recorded in New England, the Middle Atlantic States, the South and the region between the Mississippi and the Rocky Mountains.

Industrial Building Contracts of $40,000 and Up Awarded in the United States

	—Total Jan. 1 to June 1— 1928	1927
Food Products:		
Value	$13,445,000	$11,995,000
Number	74	84
Textiles:		
Value	3,213,000	2,183,000
Number	24	22
Iron and Steel Products:		
Value	4,616,000	7,133,000
Number	31	49
Leather:		
Value	336,000	199,000
Number	6	3
Rubber Products:		
Value	965,000	943,000
Number	4	7
Paper and Pulp:		
Value	5,880,000	808,000
Number	10	5
Heavy Chemicals:		
Value	3,120,000	945,000
Number	14	6
Fine Chemicals:		
Value	625,000	479,000
Number	4	3
Coke:		
Value	100,000	.....
Number	1	.....
Manufactured Gas:		
Value	8,100,000	985,000
Number	2	7
Oils, Veg., Animal		
Value	56,000	350,000
Number	1	2
Paints, Varnishes:		
Value	650,000	435,000
Number	8	4
Petroleum Refining:		
Value	1,462,000	3,859,000
Number	8	18
Rayon:		
Value	10,040,000	.....
Number	2	.....
Soap:		
Value	140,000	410,000
Number	1	3
Other Process Ind.:		
Value	2,853,000	2,094,000
Number	11	11
Lime and Cement:		
Value	234,000	1,021,000
Number	2	7
Clay and Brick Products:		
Value	749,000	1,470,000
Number	5	8
Glass:		
Value	2,140,000	425,000
Number	3	4
Public Utilities:		
Value	23,073,000	24,384,000
Number	53	49
Automotive and Garages:		
Value	12,472,000	5,802,000
Number	81	64
Machine Shops:		
Value	3,056,000	3,121,000
Number	20	27
Printing and Binding:		
Value	2,652,000	1,508,000
Number	12	13
Foundries:		
Value	701,000	1,752,000
Number	9	11
Refrigeration:		
Value	4,976,000	3,283,000
Number	10	13
Lumber, Woodworking:		
Value	900,000	1,059,000
Number	8	10
Warehouse:		
Value	5,850,000	7,939,000
Number	25	20
Unclassified:		
Value	12,289,000	13,365,000
Number	170	125
Total:		
Value	$124,693,000	$97,947,000
Number	599	575

Market Conditions

SALES activity, never very noticeable at this time of the year, was no more pronounced in one section of the country than in another last week. However, both the Middle West and Pacific Coast report a large number of construction projects for which electrical equipment will be needed. In New England there have been many small orders, with line equipment outstanding. Greater strength is shown in transformers, fractional-horsepower motors and street lighting.

Around the New York district industrial sales are the feature, utility buying being light except for transmission equipment. Jobbers have moved considerable surplus stock. The Southeast anticipates better business during the remainder of the year. Distribution transformers and poles are in demand for utilities and mill towns. Two textile mills placed orders for a total of $45,000 in electrical equipment. Increased industrial activity is reducing unemployment in the Middle West. Automobile production exceeded that of last year. A quiet week has been experienced on the Pacific Coast, although municipal purchases are heavy and oil fields are more active. Rumors again resound of electrification of the Southern Pacific's lines on San Francisco Bay peninsula.

Metal Prices Firm— Less than Average Volume

Copper in the domestic market held at 14.75 cents, Connecticut. New York lead and St. Louis zinc both remained at 6.20 cents. Sellers refuse to shade these prices and buyers decline to pay more. Some, at least, of the important consumers of copper had not covered their needs for August, for the bulk of the tonnage sold during the past week was for delivery in that month. A new production record was established during the month. The daily average for the countries that produced 98 per cent of the world's total was 5,221 tons, compared with the previous high of 4,984 in February of this year. Producers declared that the increased output was necessary to meet the growing demand. With zinc ore prices still on a $40 basis producers maintain that they cannot afford to sell slab zinc at less than 6.20 cents.

NEW YORK METAL MARKET PRICES

	July 11, 1928 Cents per Pound	July 18, 1928 Cents per Pound
Copper, electrolytic	14.525	14.525
Lead, Am. S. & R. price	6.20	6.20
Antimony	9.50	9.50
Nickel, ingot	35	35
Zinc spots	6.55	6.55
Tin, Straits	46.25	47.69
Aluminum, 99 per cent	24.30	24.30

Base copper wire price July 18, 1928, 16½ cents.

Faced with indications of a disproportionate easing in demand for lead in the Middle West, the leading lead interests in that district dropped their price to 6 cents per pound late last week. Cable manufacturers have contracted for slightly more than their usual proportion of the sales tonnage during the week. Most sales have been for July delivery, with August specification of secondary importance. Some orders have been booked as far ahead as September and October. Improvement in the London lead price has had a certain psychological effect on domestic buyers.

New England Places Many Small Orders

During the past week small orders prevailed in New England. Heavy equipment buying is quiet, but small motor sales are keeping up fairly well. One prominent manufacturer records several lot orders ranging up to $5,000. Tool and machine manufacturers are busy and active in fractional-horsepower orders. Central-station supplies are moving steadily, while transformers gained in attention and a number of orders were placed recently, with inquiries showing greater strength.

Line material is outstanding with wire, poles, cross-arms and cable reaching good heights in volume. A manufacturer received orders for insulators and control apparatus amounting to $2,000 for New Hampshire. An order for line-extension materials was placed for eastern Massachusetts. A number of electric delivery truck sales were recorded, including six trucks for newspaper delivery and four for ice delivery. Street lighting projects are active. Appliance sales are steady, with refrigerators moving rapidly. New projects are as follows:

An office building for the United Shoe Machinery Company, Boston. Burlington, Vt., plans a street lighting system to cost $100,000. Gloucester, Mass., plans a lighting system. The Commonwealth Portland Cement Corporation, Pownal, Vt., plans a mill to cost $1,200,000.

Line Equipment and Textiles Active in Southeast

The volume of business is fairly well sustained for this period of the year in the Southeast. Prospects are that the last half of the year will exceed the first half in business volume. A power company in Mississippi ordered $10,000 worth of distribution transformers and a Georgia company ordered $2,700 worth of the same equipment. Another central-station order was for creosoted pine poles amounting to $6,000. Cotton mills were in the market last week for poles going into mill village systems. A Georgia mill's purchases amounted to $1,000, while an Alabama mill ordered two carloads. An order for textile mill motors amounting to $15,000 was also placed in Alabama. A cotton mill in Georgia will let contracts on an addition to its plant and the electrical material requirements will approximate $30,000. Two "white-way" equipment orders were placed in Georgia, one amounting to $6,000 and the other $1,500. Construction projects are as follows:

The St. Petersburg Cold Storage Company, St. Petersburg, Fla., plans cold storage plants at St. Petersburg and Clearwater, Fla., to cost $250,000. The Georgia Power & Light Company, Waycross, Ga., contemplates a transmission line to Pavo and vicinity. The Carnation Milk Products Company, Oconomowoc, Wis., plans a plant at Maysville, Ky., to cost $500,000. The Mississippi Utilities Company, Jackson, Miss., plans extensions in transmission lines at Mount Olive, Miss., and vicinity. The Feldspar Milling Company, Bowditch, N. C., will build a grinding mill, to cost $75,000. Cookeville, Tenn., plans extensions in the hydro-electric plant at Burgess Falls, to cost $100,000. The Sevierville Power & Light Company, Sevierville, Tenn., will build an addition to its power plant. The United States Leather Company, Big Stone Gap, Va., plans an addition for heavy paper production as used in leather service, to cost $300,000. Springfield, Tenn., plans an ornamental lighting system to cost $30,000.

Industrial Sales Increase in Eastern District

Industrial sales featured the Eastern electrical market this week. A pump manufacturer in Connecticut placed an order for motors and control totaling $25,000. A producer of railway signal products in northern New York contracted for similar equipment amounting to $45,000, while a dish-washer manufacturer ordered small motors aggregating $50,000. A Connecticut manufacturer of talking machines placed a $40,000 commitment for disk-type fractional-horsepower motors.

Central-station buying is rather slow. Demands for prime movers and heavy machinery are lagging. Transmission line equipment is showing up better and a manufacturer of suspension and other type insulators for high voltages reports a noticeable improvement in call, with metropolitan utility companies prominent in commitments. A New York utility company has placed an order for paper-insulated cable and a testing set, totaling $40,000. Inquiries for wire and cables give promise of several sizable commitments. A producer of fuses for heavy service and kindred specialties reports trade rather spotty and inclined to reduced proportions. The best demand is for plug-type fuses; sales of cartridge fuses are lagging.

A maker of electric fans reports a marked increase in orders. Jobbers throughout the Eastern district seem to have moved considerable surplus stock carried from last year and are again in the market. According to one of the leading manufacturers of fan units, an encouraging volume of business is in sight for early commitment. Current

construction activities in the Eastern district include:

The International Paper Company, New York, plans a mill at Mobile, Ala., to cost $3,500,000. V. La Rosa & Sons, Inc., Brooklyn, N. Y., plan a macaroni factory to cost $200,000. The International Nickel Company, New York, plans a smelting plant and an addition to its concentrator near Cobalt, Ont., Canada, to cost $7,000,000. The Northern New York Utilities, Inc., Watertown, N. Y., will build a 12,000-hp. hydro-electric development on the Beaver River. The Consolidated Copper Mines Corporation, New York, will add to its mid-western properties to the extent of $150,000. The Field Force Pump Company, Elmira Heights, N. Y., contemplates an addition costing $65,000. The Public Service Electric & Gas Company, Newark, N. J., will install an underground conduit system on State Street, Perth Amboy, N. J,. and is negotiating with the city of Newark for an underground system between Newark and Port Newark, to cost $60,000; the city will install an airport lighting system for night flying at that point. The Atlantic City Electric Company, Atlantic City, N. J., will build a transmission line to Repaupo, N. J. The Edison Light & Power Company, York, Pa., will build a transmission line from its Violet Hill substation to Red Lion, Pa. The Bethlehem Shipbuilding Corporation, Baltimore, Md., plans an addition to cost $100,000. The United Railways & Electric Company, Baltimore, Md., plans a substation in the Hamilton district, to cost $150,000, with transmission lines. The Bureau of Yards and Docks, Washington, D. C., will receive bids (no closing date stated) for an automatic refrigerating machine for New York service (Specification 5652.)

Optimistic Feeling Noticeable in Middle West

The volume of business is gradually increasing in the Middle West. Greater industrial activity is reducing the number of unemployed in most of the largest centers. Building is going on at a substantial rate, particularly in the suburban districts. June production in the automotive industry exceeded last year's figures and full production is scheduled for this month. The David Lupton Sons Company of Philadelphia has decided to locate in the Clearing industrial center, Chicago, with an ultimate development plan covering 6½ acres. Among the interesting orders placed were spare parts for a 208,000-kw. turbo-generator set valued at $110,000, spare parts for coal-handling equipment valued at $20,000, selector, disconnecting and throw-over switches valued at $20,000, six complete boiler settings, one Detrich arch for reheat boilers, 75 25-kv., 75 37½-kv., 75 50-kv. and twelve 75-kv. distribution transformers. The increasing activity in the industrial field is reflected in the jobbing business only to a slight degree. Most appliances have a ready sale and the recent warm weather stimulated fan sales. Business has been good in the St. Louis district, especially in small motors and transformers. An order for a 1,000-kva. transformer involved $8,000. Oil switches for a local power company cost $20,000 and substation equipment for a new plant of a paper company cost $4,000. Motors and transformers for a woodworking factory cost $5,000, while several other orders for stock-size motors aggregated nearly $1,000 each. Construction activities are as follows:

The Willey-Ellis Company, Chicago, will soon take bids for a laundry machinery plant to cost $200,000. The Western Union Telegraph Company, Chicago, will build an equipment storage and distributing plant to cost $150,000. Chicago plans a municipal airport near Grant Park, to cost $3,000,000. The University of Chicago, Chicago, plans a central power house to cost $750,000. Springfield, Ill., contemplates a substation and extensions to the municipal lighting system. The United States Gypsum Company, Chicago, plans a mill at East Chicago, Ind., to cost $600,000. The Southern Indiana Gas & Electric Company, Evansville, Ind., plans a steam-operated electric power plant on West Ohio Street, to cost $1,500,000. The Consumers Power Company, Jackson, Mich., plans a substation at Saginaw, Mich., to cost $200,000, with transmission lines. The Motor Wheel Corporation, Lansing, Mich., will add an addition to cost $100,000. The National Carbon Coated Paper Company, Sturgis, Mich., plans a mill to cost $100,000. The Northern Pacific Railroad Company, St. Paul, Minn., will build an addition to its power plant at Hamline and Como Streets, to cost $50,000. The Union Pacific Railroad Company, St. Paul, Minn., plans shops and terminal facilities at Gering, Neb., to cost $100,000. The Chevrolet Motor Company, Detroit, plans a plant for assembling, etc., at Fargo, N. D., to cost $100,000. The Montana-Dakota Power Company, Minneapolis, Minn., plans an addition to the power plant at Marmarth, N. D. The Pennsylvania Railroad Company, Pittsburgh, contemplates the electrification of its line from Rochester, Pa., to Baird, Ohio, about 60 miles. The Christ Hospital, Cincinnati, Ohio, plans a power plant to cost $115,000. The Wisconsin Cold Storage Company, Milwaukee, Wis., plans a cold storage plant, to cost $200,000. Evanston and Niles Center, Ill., and Dubuque, Iowa, plan ornamental lighting systems.

The Fred Dold Packing Company, Wichita, Kan., will take bids in August for a plant, to cost $155,000. The Louisiana Power & Light Company, New Orleans, La., will rebuild and make extensions in the transmission line between Amite and Ponchatoula, La., to cost $40,000. The Meeker Advertising Company, Joplin, Mo., plans a plant to cost $100,000. The Universal Cutter Company, St. Louis, contemplates an addition to cost $75,000. The Market Development Company, St. Louis, plans a cold storage plant to cost $100,000. The Dallas Power & Light Company, Dallas, Tex., contemplates a transmission line to Reinhardt and vicinity. The Morten-Davis Hosiery Mills, Dallas, Tex., plans an electrically operated knitting mill, to cost $175,000. Dallas, Tex., will receive bids until Aug. 8 for equipment for municipal waterworks extensions, to cost $4,000,000, including an electric-operated pumping plant, to cost $800,000. The Farm Bureau Gin Company, Robstown, Tex., plans an electrically operated cotton gin at Driscoll, Tex., to cost $50,000. The Texas Power & Light Company, Dallas, Tex., will make extensions in transmission lines at Sacul, Tex. Springfield, Mo., contemplates a lighting system for night flying at the proposed municipal airport to cost $100,000. Waynoka, Okla., plans an ornamental lighting system to cost $25,000.

Quiet Week Reported on Pacific Coast

A slim week is reported on the Pacific Coast by all branches of the industry. Announcement that the Western Pacific intends to run tracks into San Francisco has revived rumors of the electrification of the Southern Pacific Company's 50-mile peninsula system. Power company orders have included $1,000 worth of dead ends, $1,000 worth of condulets, $1,200 worth of guy clamps, $4,500 worth of assorted bolts and three carloads of 7-in., 35-ft. treated poles. The government is in the market for eleven motor-driven lathes for Mare Island. Miscellaneous orders include 70 floodlights for San Francisco, valued at $2,500, and 12,000 ft. 1½-in. conduit for street lighting reconstruction. Interesting projected business includes a new hotel for Long Beach and an $800,000 bank and office building for Tucson, a paper mill for Butte County, a $2,000,000 furniture factory for Los Angeles, $300,000 bonds to be voted by Sacramento for a new fire alarm system and five new units for the Redwood City high school. Increased oil field activity is indicated by such orders as $2,500 worth of transformers and $5,000 wortn of heavy drilling motors for the Kern district, besides equipment for four new service stations.

Seattle is preparing plans for a downtown substation to cost approximately $1,000,000. Contracts have been let for 150,000 lb. of weatherproof wire costing $26,000, bids have been called for 380,000 lb. of No. 4/0 stranded bare copper wire or equivalent aluminum, pole-line hardware and 20,000 lb. of galvanized guy wire and insulators. Two central stations operating in Okanogan County have joined forces to build 40 miles of transmission line. A $60,000 woodworking plant is projected at Olympia and a large lacquer plant in Seattle. Construction plans include:

Glendale, Ariz., will install a municipal fire alarm system to cost $30,000. The Arizona Magma & Mining Company, Kingman, Ariz., plans a flotation mill at its Diana mines, to cost $100,000. The Salt River Valley Water Users' Association, Phoenix, Ariz., will issue bonds for a $5,100,000 hydro-electric plant. Los Angeles is arranging a fund of $7,300,000, for a power plant, transmission line and auxiliary construction. The Simons Company, Kenosha, Wis., manufacturer of brass and iron bedsteads, etc., will build a factory and distributing plant at San Francisco, to cost $200,000. The Mountain States Power Company, Tacoma, Wash., will make extensions in the hydro-electric plant at Big Fork, Mont. The Fir-Tex Insulating Board Company, Portland, Ore., plans a power plant at the proposed mill near St. Helens, Ore., to cost $1,000,000. The National Paper Products Company, San Francisco, will build a mill at Port Townsend, Wash., to cost $350,000. The Northwest Lead Company, Seattle, Wash., plans an addition to cost $80,000. The Consolidated Mining & Smelting Company, Trail, B. C., Canada, plans a hydro-electric plant to cost $1,000,000, with transmission lines. Oakland, Calif., Walsenburg, Colo., and Sacramento, Calif., plan ornamental lighting systems.

Activities of the Trade

Casey-Hedges Combines with Walsh & Weidner

Consolidation of the Casey-Hedges Company and the Walsh & Weidner Boiler Company, two well-known boiler manufacturers, has recently been announced. These firms are both located in Chattanooga, Tenn., and have a combined record covering more than 80 years. The consolidation will be known as the Hedges-Walsh-Weidner Company. The directors of the new company are M. M. Hedges, president; L. H. McGowan, T. H. Johnson, J. R. Hedges, Charles Hill, S. H. Daniels, A. C. Weigel, C. P. Dewellyn and George T. Smith.

General Electric Sales Up 5½ per Cent

General Electric Company sales billed for the first half of 1928 amounted to $158,015,221, compared with $149,795,026 for the corresponding period last year, President Gerard Swope has announced. Profit available for dividends on common stock for the first half of 1928 was $24,388,002.58, compared with $22,542,972.26 for the corresponding six months last year.

A comparative statement of sales and earnings for the six months is given in the following table:

	1928	1927
Net sales billed	$158,015,221	$149,795,026
Less: Cost of sales billed, including operating, maintenance and depreciation charges, reserves and provision for all taxes	138,889,039	130,930,258
Net income from sales	$19,126,182	$18,864,769
Other income, less interest paid and sundry charges	6,549,125	4,965,394
Profit available for dividends	$25,675,307	$23,830,163
Less: Cash dividends on special stock	1,287,305	1,287,190
Profit available for dividends on common stock (7,211,481 84/100 shares issued)	$24,388,002	$22,542,973

The profit available for common stock for the six months is equivalent to $3.38 per share in 1928 and $3.13 per share in 1927.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., manufacturer of portable electric tools, has placed on the market a new ¾-in. heavy duty portable electric drill.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, announces that its sales branches in Los Angeles and San Francisco, Calif., and Seattle, Wash., and its service branches in Los Angeles, Oakland and Seattle have been supplemented by the establishment of a complete warehousing and service depot at 525 East Tenth Street, Oakland, Calif. The sales departments will be operated separately, with the following branch managers in charge: Waldo H. Bair, 857 South San Pedro Street, Los Angeles; Harry W. White, 75 Fremont Street, San Francisco, and Roy Wise, 514 Virginia Street, Seattle.

Chicago Steel Tank to Sell Direct to Field

The formation of an electrical sales division in charge of Clyde W. Lynch, formerly sales manager for Paul W. Koch & Company of Chicago, is announced by the Chicago Steel Tank Company, 6400 West 66th Street, Chicago. The company will re-enter the direct sales field and will sell its line of electrical conduit fittings, which in the past has been marketed under the private trade names of other manufacturers.

The company will use the trade name "C.S.T. Superior" and its line will consist of armored cable connections, lock nuts and bushings, conduit nipples, extension pieces, etc. The company also announces the appointment of the Burg Electric Sales Company, 32 Union Square, New York, and 3021 Arch Street, Philadelphia, as its sales representative for the North Atlantic States.

THE OKONITE COMPANY, New York, manufacturer of wires and cables, announces the opening of a branch office at 1808 Allen Building, Dallas, Tex.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Sheffield Steel Corporation, Kansas City, Mo., for the electrical equipment to be used in a steel mill which will have a capacity of 10,000 tons a month. It will operate chiefly on scrap obtained locally, including old automobiles, since it has been estimated that enough raw material can be secured in this way to supply a large proportion of the local demand for steel products.

THE ARROW ELECTRIC COMPANY, Hartford, Conn., manufacturer of wiring devices, announces a new Arrow porcelain pull receptacle having a one-piece porcelain shell.

THE AUTOMATIC ELECTRIC HEATER COMPANY, 1505 Race Street, Philadelphia, manufacturer of "Sepco" electric water heaters, announces the removal of its sales offices to larger quarters at 1706 Race Street, Philadelphia.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has leased 3,000 sq.ft. of space in the Lexington Building, Baltimore, Md., for a period of five years, beginning Aug. 1, and will remove its local offices there.

Oil-O-Matic Holds Big Sales Convention

One of the largest industrial conventions held by a single organization has just been reported by the Williams Oil-O-Matic Heating Corporation, Bloomington, Ill. By actual count 2,700 delegates attended, representing practically every state in the Union. A large delegation was present from Canada, and Australia and other countries were represented. A new advertising program was announced which will include *Radio, National Magazine,* direct mail and co-operative newspaper advertising. C. U. Williams, president of the company, pointed out that never before have conditions been so favorable to the progress of oil heating. Many oil companies are offering oil for oil burners on two and three year contracts. He reported almost 1,000,000 oil burners in operation on this continent.

THE ELECTRIC POWER EQUIPMENT CORPORATION, 412 North Eighteenth Street, Philadelphia, announces the appointment of Elgin B. Robertson as its representative in Dallas, Tex. Mr. Robertson, formerly district sales manager of the Railway & Industrial Engineering Company, Chicago, has opened an office at 711 Southwestern Life Building, Dallas, as sales engineer and also will represent the Lapp Insulator Company, Le Roy, N. Y., and the Hydroil Sales Corporation, Lebanon, Ind.

THE ELECTRIC VACUUM CLEANER COMPANY, INC., Cleveland, announces that Oliver B. Capelle, Cleveland, has joined the organization and will be in charge of sales promotion for the company and its subsidiary, the Premier Service Company. Mr. Capelle was formerly with the Peerless Motor Car Corporation and the Apex Electric Manufacturing Company, Cleveland.

THE IDEAL COMMUTATOR DRESSER COMPANY, Sycamore, Ill., announces the new improved Ideal mica undercutter.

CHARLES F. LACOMBE AND WILLIAM S. LEFFLER, 135 Broadway, New York City, engineers, announce the removal of their offices to the Salmon Towers Building, 11 West 42d Street, New York City.

EDWARDS & COMPANY, INC., 140th and Exterior Streets, New York City, manufacturer of electric signaling devices, announces that it has opened a branch office at 1000 Plymouth Building, Minneapolis, Minn., with V. L. Warren in charge.

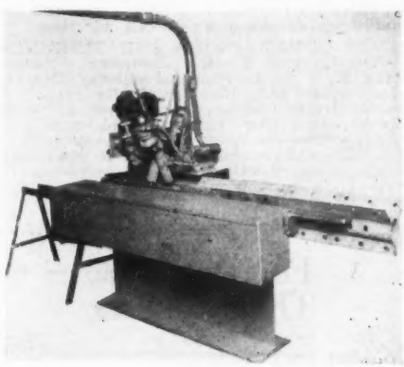
THE ROBBINS & MYERS COMPANY, Springfield, Ohio, manufacturer of electric motors, generators and fans, announces that W. J. Myers, formerly receiver, was appointed vice-president and general manager at a recent meeting of the board of directors. The directors who were elected are as follows: S. B. Cramer, Sterling Newell, P. J. Shouvlin, W. S. Quinlan, M. H. Murch, W. J. Myers, C. A. Stirling.

New Equipment Available

Electronic Tornado Welding Machine

The application of the "Electronic Tornado" principle of welding has been applied to commercial machines by the Lincoln Electric Company, Cleveland. An automatic welding machine using this principle is shown in the accompanying illustration. In the machine shown there are two of the new type welding heads with their electrode holders crossing each other at a sharp angle. Control of the arc through the electronic tornado principle makes this possible. The welder shown was designed to produce oil well tubular derrick corner clamps and is placing welds at the rate of better than 40 ft. an hour for each head. No filler rod is used, the arc fusing the various plates together.

In general with this type of machine



Automatic welder utilizing the "Electronic Tornado" principle of welding

the company states that the cost of welding of, say, ½-in. plates, including operators' time, electric current and carbon electrodes, will not exceed 3 to 7 cents. The cost of welding plates of other thickness will be in direct proportion. Whereas heretofore the metal deposited by electric arc welding has partaken of the characteristics of cast steel, the metal deposited by the "Electronic Tornado" weld has much better physical characteristics and approaches very closely the character of the plates which it is joining.

LOW-VOLTAGE BUS SUPPORTS. — A line of 220 to 4,500-volt bus supports has been designed by the Delta-Star Electric Company, Chicago. The manufacturer states that the insulator units have a dry flashover of 38,000 volts with an ultimate tensile strength of 3,000 lb.

SPRAY GUN.—A dialed head which gives numerous different spray adjustments from a circular spray to a fan of a wider field has been incorporated in the type EF paint spray gun made by the Alexander Milburn Company, 1416 W. Baltimore Street, Baltimore, Md. The dialing permits the operator to obtain any desired spray instantly without first making tests. This new spray gun supersedes the type E gun formerly manufactured, although the company states that the type E gun can be readily fitted with the improvements by returning it to the factory.

Air Compressor

An improved air-cushioned air compressor valve is now being used in the air compressors manufactured by the Pennsylvania Pump & Compressor Company, Easton, Pa. The manufacturer claims for this new valve simplicity, durability, efficiency and safety. An important feature of the valve is the air-cushion pocket in the guard. As the valve opens, instead of striking the guard the disks enter the air pocket and the air trapped in the pocket provides a cushion which prevents the valve from striking the metal of the guard. The valve assembly is held together by means of a retaining ring which engages the valve guard and seat and no bolt screws or nuts are used in the construction, thus eliminating the possibility of any part becoming loose and falling into the cylinder to do damage to the compressor.

Hand Control Switch

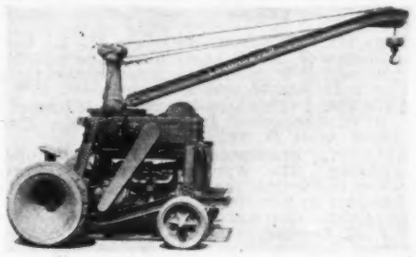
For application where it is desirable to control a magnetic switch at the switch itself, the General Electric Company has designed two small control switches. These may be mounted in the knockouts of the inclosing case of any starter and are held rigidly in place by a conduit bushing which forms part of the switch. One type, bearing the designation SY-103-A, is a maintaining-contact type whose action is similar to a single-pole, double-throw switch. It is provided with three positions, "Hand," "Off" and "Automatic." The most general application of this switch is expected to be in connection with refrigerating machines controlled by thermostats, but it can also be used where float switches, pressure governors, etc., are used in the same manner as a thermostat in various applications.

The second type of switch bears the designation SY-104-A and is a two-position, momentary-contact switch provided with the positions "Start" and "Stop." This is the equivalent of the usual push-button station of the same marking. It is most applicable where starting and stopping of the motor are necessary at the magnetic switch itself. Both switches are equipped with leads ready to wire and have sufficient capacity to handle any magnetic starter up to 75 amp. capacity. The new switches can be used on 600-volt circuits.

Swing-Crane

The "Loadmaster" swing-crane, a locomotive type crane for general utility in industrial plants, utility plants, etc., has been placed on the market by Frederic H. Poor, Inc., 50 Church Street, New York City. The manufacturer claims that the swinging crane is of moderate price and is capable of easily handling loads which cannot be advantageously handled by manual labor, which are either too small to justify the installation of large and costly crane units, or loads which by reason of their location are not within reach of ordinary hoist service. As shown in the illustration, the "Loadmaster" is mounted on an industrial tractor.

It can move from place to place under its own motive power and the power for lifting and freeing loads is derived from the tractor engine. The "Loadmaster" also may be used to haul loads or trailers attached to the tractor upon which the crane is mounted. Specially weighted wheels are employed at both rear and front to counterbalance loads in suspension from the boom and broad tires upon these wheels sustain the loads without undue tire loading. The frame upon which the mast is located consists



Locomotive type crane for industrial and utility plants and other general service

of a fabricated plate and channel structure secured at the rear to the axle housing of the tractor and is suspended at the front in such a way as to compensate for irregularities of the floor or roadbed over which the machine travels. The swinging boom is constructed of two steel channels firmly braced together and equipped with the necessary sheaves and hook weight. The maximum loads are of course lifted at the short outreaches. With the boom directly in front of the tractor 3,000 lb. can be lifted at a 5-ft. 6-in. outreach and 2,400 lb. at a 10-ft. outreach. With the side swing 1,800 lb. can be lifted at a 5-ft. 6-in. outreach and 1,000 lb. at a 10-ft. outreach.

DIRECT DIFFERENTIAL HOIST.—A new direct differential hoist is being marketed under the trade name "Blue Boy" by the Chisholm-Moore Hoist Corporation, Cleveland. It is equipped with the Hercules-Inswell electric welded load chain, which the manufacturers state gives it a high degree of safety. The hoist is painted blue and the chain is copper plated.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 26, 1928)

1,674,663. SWITCH MECHANISM; L. R. Ruthenburg, East Moline, Ill. App. filed Nov. 20, 1922. For controlling the operation of self propelled vehicles.

1,674,670. ELECTRIC TRANSFORMER; A. C. Taylor, Warren, Ohio. App. filed Sept. 10, 1923. For use with electric heating and welding apparatus.

1,674,688. ELECTRICAL INDICATING INSTRUMENT; W. C. McCoy, Cleveland, Ohio. App. filed Aug. 2, 1926. For use in connection with remotely controlled indicator systems.

1,674,692. PORTABLE ELECTRIC ROASTER; C. J. McHugh and D. S. Rivers, Indianapolis, Ind. App. filed Nov. 30, 1926.

1,674,745. METHOD OF FORMING DRY-BATTERY STRUCTURES; C. T. Schunk, Lakewood, Ohio. App. filed Jan. 14, 1928.

1,674,747. ALTERNATING-CURRENT ELECTROMAGNETICALLY-OPERATED DEVICE; W. C. Stevens and A. Simon, Milwaukee, Wis. App. filed July 24, 1916. Switches of the clapper type.

1,674,757. REMOTE-CONTROL SWITCH APPARATUS; C. W. Bates, Narberth, Pa. App. filed Dec. 14, 1922. Using resonant relays.

1,674,783. ELECTRICAL CIRCUIT CONTROLLER; L. V. Lewis, Edgewood Borough, Pa. App. filed Aug. 20, 1925.

1,674,799. CABLE TERMINAL FOR BATTERIES; E. E. Richardson, Quincy, Ill. App. filed March 16, 1926.

1,674,829. WATER-COOLED CABLE CONNECTION FOR ELECTRIC WELDING; W. J. La Bean, Detroit, Mich. App. filed Dec. 6, 1926.

1,674,868. ELECTRIC SWITCH; T. L. Lee, Rochester, N. Y. App. filed June 8, 1921. In which a contact-member in the form of a laminated spring is used.

1,674,876. DYNAMO-ELECTRIC MACHINE; R. G. Thompson, Rochester, N. Y. App. filed April 28, 1924.

1,674,887. ELECTRODE CAP; J. H. Channon, Chicago, Ill. App. filed April 26, 1924. For indicating the condition of the electrolyte in a battery.

1,674,892. CONTROL MEANS FOR SWITCHES; J. K. Duncan, Almonte, Ont., Can. App. filed Sept. 2, 1927. Rotary switch.

1,674,905. INSULATOR; W. D. Kyle and L. E. Hendee, Milwaukee, Wis. App. filed June 24, 1922. Adapted for attaching wires to buildings.

1,674,917. SNAP SWITCH; T. L. Parker, Chicago, Ill. App. filed Oct. 4, 1924.

1,674,934. COIL AND METHOD OF MAKING SAME; J. A. Victoreen, Cleveland, Ohio. App. filed April 28, 1924. High frequency coil.

1,674,947. METALLURGICAL FURNACE; E. H. Bunce and G. T. Mahler, Palmerton, Pa. App. filed Dec. 10, 1925. For making metallic oxides.

1,674,982. ELECTRIC FURNACE AND METHOD OF CARBONIZING METALLIC CHARGES THEREIN; W. E. Moore, Pittsburgh, Pa. App. filed May 11, 1922.

1,674,995. ELECTRIC STOVE AND METHOD OF ASSEMBLING SAME; E. A. Rutenber, Milwaukee, Wis. App. filed May 28, 1924.

1,675,007. STRAP-TYPE CLAMP; W. H. Vibber, New London, Conn. App. filed Sept. 29, 1926.

1,675,016. ELECTRIC SOCKET; C. J. Alpaugh, Mercersville, N. J. App. filed Nov. 4, 1926. Adapted to be mounted in recesses in building walls.

1,675,057. APPARATUS FOR RECTIFICATION OF HIGH-TENSION ALTERNATING CURRENT; W. A. Schmidt, Los Angeles, Calif. App. filed July 19, 1920.

1,675,062. CONTROL FOR INTERMITTENT MOTORS; C. H. Smoot, Maplewood, N. J. App. filed Jan. 13, 1925.

1,675,091. ELECTRIC FIRELESS COOKER; W. Campbell, Alliance, Ohio. App. filed June 17, 1925.

1,675,114. POLE CONNECTER OF ELECTRIC BATTERIES; R. J. Laird, Auckland, N. Z. App. filed Sept. 8, 1927.

1,675,148. ELECTROMAGNETIC DEVICE; D. G. Ackerly, Wilkinsburg, Pa. App. filed Oct. 18, 1926. For use as electrical relay.

1,675,163. GROUND CLAMP; B. E. Colburn, Green Bay, Wis. App. filed Aug. 13, 1926.

1,675,185. ELECTRIC SWITCH; J. Lofgren, Chicago, Ill. App. filed Nov. 2, 1925. For locomotive headlights.

1,675,205. TILTABLE MULTIPLE-CONTACT SWITCH; K. Bayerle, Frankfort-on-the-Main, Germany. App. filed March 6, 1925. Working with an electric conducting liquid.

1,675,219. JUNCTION BOX; S. L. Kent, Jr., Lansdowne, Pa. App. filed Dec. 31, 1923.

1,675,229. ELECTRIC INCANDESCENT LAMP; F. Skaupy, Berlin, Germany. App. filed Oct. 13, 1922. In which light is emitted by selective radiation.

1,675,235. WIRE-STRINGING PILOT; H. J. Westhaver, San Diego, Calif. App. filed Sept. 20, 1927.

1,675,237. ELECTRIC FURNACE; M. Unger, Pittsfield, Mass. App. filed Dec. 9, 1926.

1,675,290. ELECTRIC-SWITCH-OPERATING MECHANISM; C. D. Ainsworth, Wollaston, Mass. App. filed Dec. 13, 1922.

1,675,292. ELECTRICAL TIME SWITCH; G. A. Burgess, Waukegan, Ill. App. filed June 7, 1926.

1,675,293. ELECTRIC CIGAR LIGHTER; C. H. Cuno, Meriden, Conn. App. filed Sept. 19, 1925.

(Issued July 3, 1928)

1,675,321. SECONDARY OR STORAGE BATTERY; C. Ambruster, Roslyn, Pa. App. filed Nov. 23, 1925.

1,675,322. CIRCUIT BREAKER; C. E. Anderson, Stratford, Conn. App. filed July 17, 1925. Manually and thermostatically operated.

1,675,333. CONTROL MECHANISM; R. E. De Camp, Glendale, Calif. App. filed Nov. 11, 1919. Motor control.

1,675,336. RELAY SYSTEM; W. O. Edmonds, Kansas City, Mo. App. filed Feb. 1, 1924. For controlling the operation of automatic transformer stations.

1,675,340. THERMAL REGULATOR; H. S. Gano, Wilkinsburg, Pa. App. filed Jan. 16, 1924. A regulator actuated by heating winding.

1,675,353. SAFETY PLUG AND LAMP SOCKET; L. Kellner, Chicago, Ill. App. filed May 16, 1925.

1,675,356. MOTOR-CONTROL SYSTEM; T. P. Kirkpatrick, Wilkinsburg, Pa. App. filed Oct. 4, 1922. For driving loads having unusually heavy fly-wheel effects.

1,675,359. REGULATING APPARATUS; G. W. Kuntney, Waterbury, and C. W. Bristol, Naugatuck, Conn. App. filed Aug. 12, 1926.

1,675,370. THERMAL RELAY; F. H. Miller, Wilkinsburg, Pa. App. filed June 9, 1920.

1,675,380. ELECTRIC-LIGHT-BULB CAP; F. W. Pund, Cincinnati, Ohio. App. filed July 6, 1927.

1,675,381. AUTOMATIC HYDRO-ELECTRIC STATION; M. E. Reagan, Pittsburgh, Pa. App. filed Oct. 15, 1923.

1,675,391. VIBRATION DAMPER; G. H. Stockbridge, Los Angeles, Calif. App. filed Nov. 12, 1925. For suspended conductors as used in transmission lines.

1,675,396. THERMAL RELAY; H. E. White, Wilkinsburg, Pa. App. filed May 4, 1925.

1,675,401. COMBINED HOLDER AND AUTOMATIC CIRCUIT BREAKER FOR ELECTRIC SOLDERING IRONS; W. Alferink, Cleveland, Ohio. App. filed Dec. 22, 1926.

1,675,408. ELECTRICAL-CONDUCTOR-PROTECTING MEANS; G. P. Edmonds, Chicago, Ill. App. filed Nov. 2, 1925. To prevent the passage of moisture along the threads of the threaded members and into the inclosure to protect insulation of the electrical conductors from rupturing.

1,675,418. ELECTRIC FIREPLACE; D. N. Meany and E. N. Ellsworth, Chicago, Ill. App. filed Nov. 24, 1924.

1,675,419. PROCESS OF INSULATING MOTOR WINDINGS; T. G. Myers, Los Angeles, Calif. App. filed Feb. 9, 1927.

1,675,421. COVERING FOR CABLES AND THE LIKE; A. D. Pettee, Mount Vernon, and C. H. Shaw, Jackson Heights, N. Y. App. filed July 2, 1927. Adapted to serve as an anchorage or reinforcement for cement or other suitable fireproofing or heat insulating material or other plastic coating.

1,675,435. ELECTRICAL SWITCH; G. B. Wadsworth, Covington, Ky. App. filed March 24, 1921. Inclosed type, externally operated.

1,675,467, 1,675,468. INCLOSED ELECTRIC SWITCH AND METHOD OF ASSEMBLING THE SAME; J. Sachs, Hartford, Conn. App. filed Jan. 28, 1922.

1,675,477. GOVERNOR; J. B. Wilson, Chicago, Ill. App. filed Nov. 19, 1925. For turbo-generator set.

1,675,495. PROTECTIVE DEVICE FOR COMPENSATED ASYNCHRONOUS MOTORS; F. Kade, Kiel, Germany. App. filed Mar. 11, 1925.

1,675,554. INCANDESCENT-ELECTRIC-LAMP SOCKET, LAMP, AND ADAPTER THEREFOR; A. S. Howell, Chicago, Ill. App. filed Feb. 23, 1923. As used in motion picture machines.

1,675,586. ELECTRON-DISCHARGE APPARATUS; W. C. White, Schenectady, N. Y. App. filed June 5, 1922.

1,675,589. INSULATOR; O. D. Babineau, Minneapolis, Minn. App. filed Dec. 7, 1925. Low voltage.

New Trade Literature

AUTOMATIC STATIONS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-90C which lists the automatic station installations made up to January 1, 1928 with some typical installations.

CAR EQUIPMENT.—The Ohio Brass Company, Mansfield, Ohio, is distributing a catalog in which it describes and illustrates its car equipment including trolley bases, trolley catchers and retrievers, trolley wheels and harps, sander equipment, automatic car couplers and headlights.

OIL CIRCUIT BREAKERS. — Bulletin GEA-101B issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its types FK and FKO-236 station oil circuit breakers for 15,000 volts and 400 and 800-amp. service. Bulletin GEA-974 issued by the company gives the dimensions of type FKR-55 oil circuit breakers and bulletin GEA-988 gives the dimensions of types FK-330 and FHK-330 station oil circuit breakers.

OIL HEATERS.—The Oil Heating Institute, 420 Madison Avenue, New York City, has issued a catalog entitled "Are Oil Heaters Perfected?" which gives information about oil heaters and introduces a table of comparative costs prepared from studies of the United States Bureau of Standards. It contains descriptions and illustrations of the oil heating equipment made by the various manufacturers who are members of the Oil Heating Institute.

AIRPORTS AND AVIATION BUILDINGS.—The Austin Company, Cleveland, has published a booklet on airports and aviation buildings designed and built by them.

AIR COMPRESSORS AND TURBINES. —The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-941 describing and illustrating its type CP, motor-driven, center-gear, reciprocating air compressors for railway and industrial service. The company also has issued bulletin GEA-953 covering its type R steam turbines and bulletin GEA-957 covering its type D-53 mechanical drive turbines.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Stuttgart, Germany (No. 32,122), for electric cloth-cutting machines.

An agency is desired in Dresden, Germany (No. 32,127), for electric cloth-cutting machines.

Purchase and agency are desired in Calcutta, India (No. 32,120), for ceiling and desk fans and cheap electrical fixtures and parts.

An agency is desired in Bombay, India (No. 32,167), for flashlights.

Purchase and agency are desired in Hamburg, Germany (No. 32,171), for household electrical appliances and another (No. 32,213) for industrial electric trucks.

Purchase or agency is desired in Hamburg, Germany (No. 32,172), for household electrical appliances.

Purchase is desired in Santo Domingo, Dominican Republic (No. 32,224), of household electrical appliances and electric welding outfits.

Purchase and agency are desired in Santos, Brazil (No. 32,177), for household electrical appliances and portable electric tools.

An agency is desired in Hainau, Germany (No. 32,123), for electric household refrigerators and units.

An agency is desired in Berlin, Germany (No. 32,124), for electric household refrigerators and units.

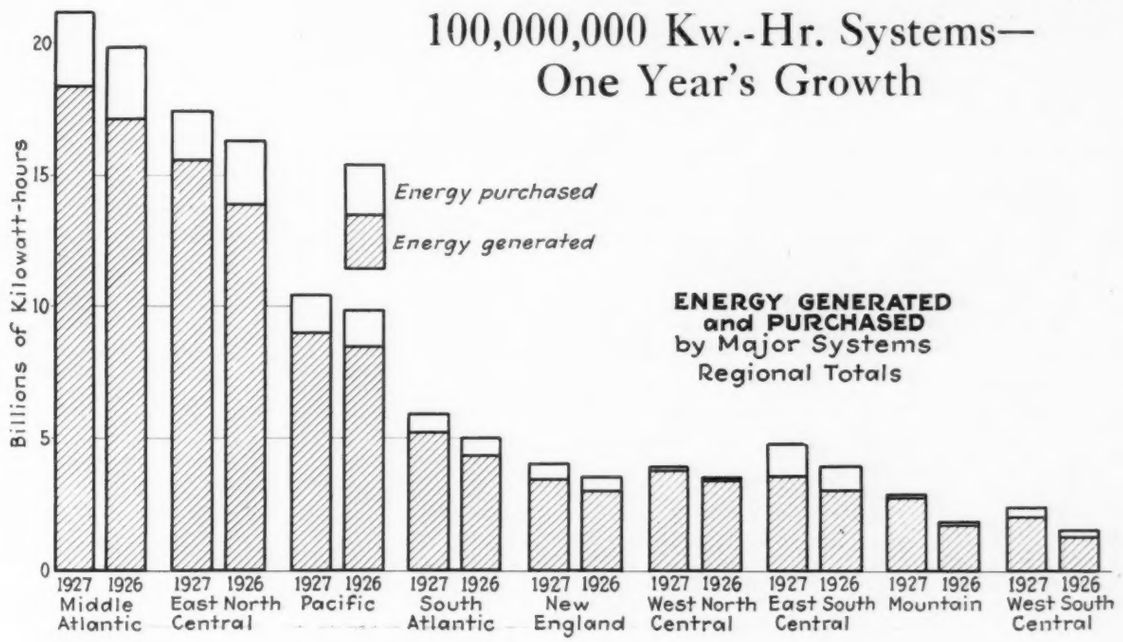
An agency is desired in Aschaffenburg, Germany (No. 32,125), for electric household refrigerators and units.

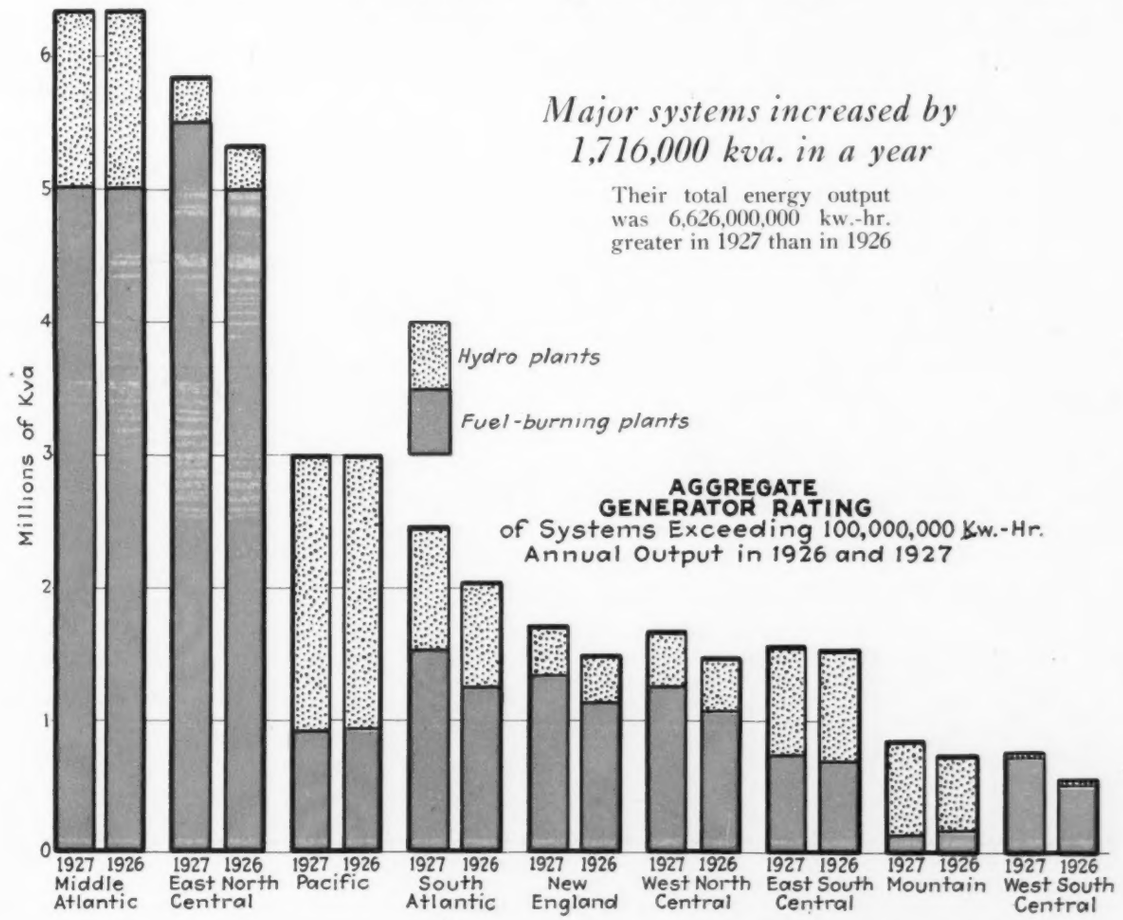
An agency is desired in Wurtemburg, Germany (No. 32,126), for electric household refrigerators and units.

Purchase is desired in Lille, France (No. 32,225), of industrial welding and testing apparatus.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business





New England 1928 Production Slightly Decreased

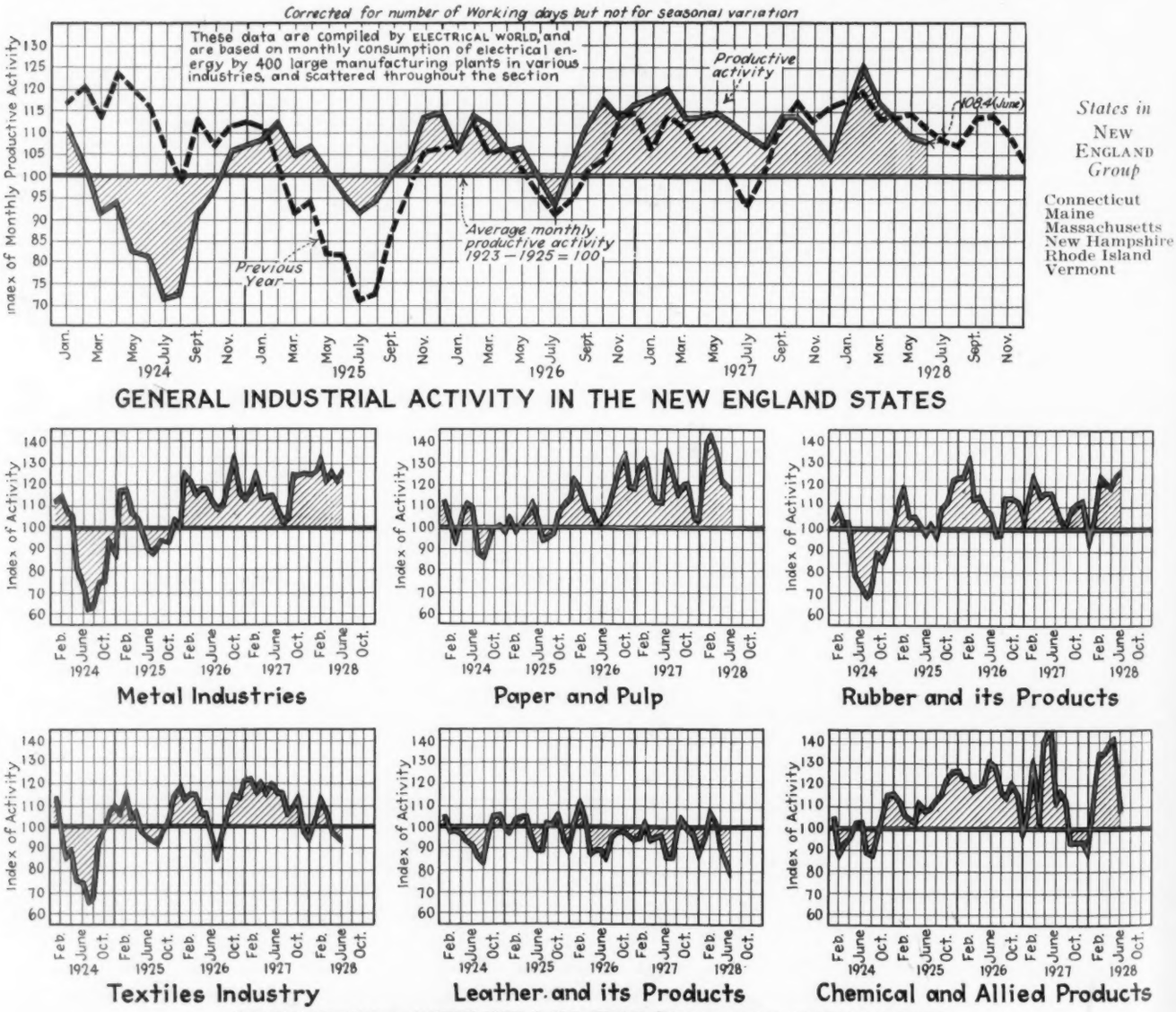
WHILE the half year just closed did not record an increased general production over the same period last year by the manufacturing plants of New England, yet the decrease was very small, less than 1 per cent. In fact, two of the six months recorded material increases in productive activity over the same month last year. The monthly consumption of electrical energy by the manufacturing plants of New England as collected by the ELECTRICAL WORLD is the basis upon which these statements are made.

While the nation as a whole witnessed an increase in general productive operations of 2.8 per cent during the half-year period, yet the difference between the trends in the nation as a whole and in the New England States is not nearly as drastic as some statements would lead one to believe. It is true that the textile industry in the section has been operating materially under last year, and that this is one of the most important industries of the section. But it is not the only important industry, and its comparative importance has been growing less and less since the war period. Ferrous and non-ferrous metal-working plants, steel plants, the leather and the paper and pulp industry have all increased their relative influence on the general industrial structure as the decade has advanced.

Indexes of Productive Activity in the New England States
(Average Monthly 1923–25 = 100)
All Figures Adjusted for Number of Working Days

Industry	June, 1928	May, 1928	June, 1927	Average, First Half 1928	Average, First Half 1927
All industry	108.4	109.1	112.0	114.8	115.4
Chemical and allied products	109.4	142.5	112.0	130.5	125.9
Leather and its products	79.5	83.8	86.4	93.3	94.3
Lumber and its products	103.4	103.2	92.7	107.7	.....
Metals group	127.6	120.2	110.8	125.7	116.0
Rolling mills and steel plants	130.6	110.0	.....	130.6	.....
Metal-working plants	126.4	124.4	.....	126.4	.....
Paper and pulp	116.6	120.0	135.3	129.3	121.9
Rubber and its products	127.9	125.0	113.4	120.9	116.3
Textiles	93.7	96.3	116.5	102.3	118.3
General industry, U S	116.4	119.0	112.5	119.8	116.5

ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Productive activity
(108.4 (June))
Average monthly productive activity 1923 – 1925 = 100
Previous Year
Index of Monthly Productive Activity
States in NEW ENGLAND Group
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont
GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES
Index of Activity
Metal Industries
Paper and Pulp
Rubber and its Products
Textiles Industry
Leather and its Products
Chemical and Allied Products
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES